NEW ZEALAND GEOGRAPHER

THE OXFORD ATLAS
FOR
NEW ZEALAND

Advisory Editor: R. G. LISTER (Head of the Department of Geography, University of Otago)

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New Zealand Geographer

VOLUME XV October, 1959 NUMBER 2

THE ELEMENT OF CHANGE IN PALMERSTON NORTH*

A. GRANT ANDERSON

PALMERSTON NORTH, with a population of 38,000, is the sixth city in New Zealand. It functions both as the regional focus for a productive farming district and as the centre of important servicing and manufacturing industries. Since its establishment in 1870 Palmerston North has displayed a steady and unchecked growth that reflects, among other things, its position in the railway system of the North Island, and the progressive development of its tributary area. In many ways it must be an ideal laboratory for the social scientist, or for that matter, for anybody intent on testing out ideas about a representative New Zealand urban community. This article, however, is confined to a study of the central area of the city, and more particularly, to the retail section of the central business district. Its main purpose is to present and to elucidate an underlying concept that settlement, whether it be town or village, is one of the material aspects of a culture, and as such reflects in its spatial arrangement, function and appearance many of the characteristics of society.

DEVELOPMENT OF THE CENTRAL AREA

European settlement of the Manawatu was delayed until the late 1860's largely because of the relative remoteness of the area, the reluctance of some of the local Maoris to sell their land, and the confusion that existed over the question of which tribe—the Rangitane who were the original inhabitants, or the conquering Ngati Raukawa—held pre-emptive rights to the land. The lowlands were densely forested, but a clearing of some 900 acres had been discovered near the Manawatu River, and this was chosen as the site for the town of

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*Based on a paper presented to the Second New Zealand Geography Conference at Christchurch, August 1958.

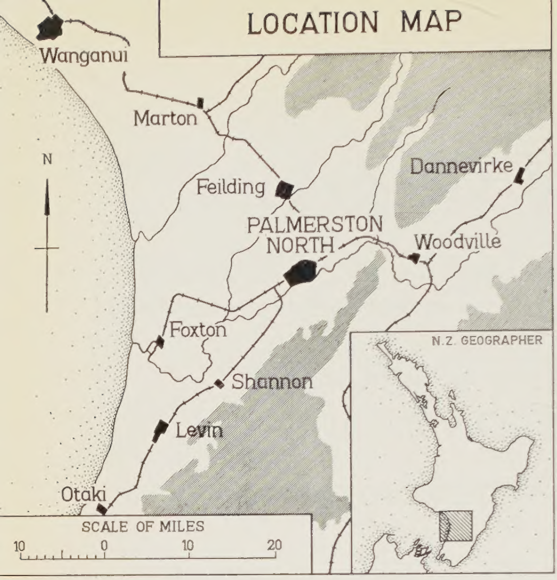

Fig. 1. The location of Palmerston North. Land over 1,000 feet in height is shaded

Palmerston (*Fig.* 2). In applying the plan to the site, the surveyors made some modifications which they apparently felt reconciled the formal grid to the site itself. The plan was aligned so that Church Street should follow the edge of one of the broad terraces, and the whole plan was orientated in a northeast to southwest direction. The central square was laid out at the southern edge of the clearing, apparently in order to align Fitzherbert Avenue with a suitable bridging point on the river, and to avoid a meandering water course that would have necessitated expensive bridging. Another modification of the formal grid seems to have been the result of a deliberate attempt to break the symmetry of the plan. An example of this, which may have had a significant effect on the subsequent growth of the retail section of the town, was the termination of Broad Street on George Street, making Cuba Street continuous with the westerly thoroughfare and thus effectively preventing a westward expansion from the Square.

Beginnings of Settlement

The central square attracted the first shop when, in 1870, a small store was opened on the northwestern side. However, the higher and better-drained land at the northeastern end of the clearing attracted early settlement, and two sawmills that were important in the early economy of the town were established here at Terrace End. It is interesting to observe that the first station on the early tramline from Palmerston North to Foxton was erected in Main Street east of the Square—something of a compromise between the two centres. This was later moved to the centre of the Square, where it remained until it was shifted to its present site in Main Street in 1899.

Between 1870 and 1900 the forest in the surrounding area was steadily cleared and the land converted to farmland, so that in this period Palmerston North was transformed from a milltown to a marketing centre for a farming community. This transformation was reinforced by the developments that had taken place in communications over the same period. In 1877 the railway replaced the pioneer tramline which linked the town with Foxton, the river port. In the following year the line to Wanganui was opened, and in 1886 the Wellington and Manawatu Railway Company completed the connection with Wellington, the overseas port. In 1891 the railway network in the southern part of the North Island was completed when a line was opened through the Manawatu Gorge to link at Woodville the Wellington–Napier line, and the final stage came in 1908 with the opening of the main trunk line to Auckland. Thus Palmerston North, born as a milltown in the heart of the bush, had by 1900 become a marketing centre for a growing farming population and a focal point in the railway system.

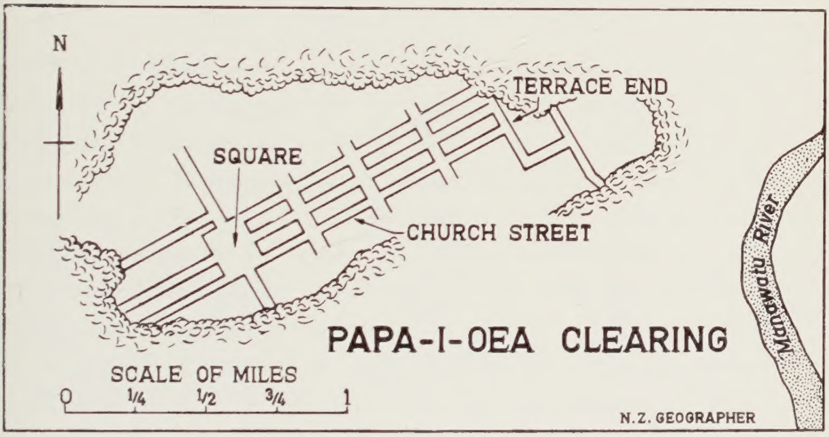

Fig. 2. The site of Palmerston North

This growth and change in character was reflected in the expansion of retail services, and by 1900 the Square itself was almost completely encircled by shops—mainly two-storeyed wooden buildings, with offices and living quarters above. It was apparent even at this stage that the northern corner and the northwestern side of the Square had become the main focus of retail activity, and its pre-eminence never seems to have been seriously challenged until the more recent development on Broadway,[1] which is really only an extension of this area. Its accessibility along Broad Street from the Terrace End area, and along Rangitikei Street, as well as from the station in the centre of the Square, was undoubtedly the most important factor, but strengthening this was the protection this side of the Square offered to shoppers from the strong westerlies that plague the city. In 1904 there were at least eleven shops here supplying personal adornments—clothing, jewellery and footwear—as well as six food shops and two restaurants, several chemists and hairdressers, saddlers and others.[2]

PRE-EMINENCE OF PALMERSTON NORTH

Since 1900 Palmerston North has continued to outstrip other towns in the area, and the retail section of the city reflects its increasing stature as a regional centre (Table I). Some of the factors that have contributed to its growth have already been suggested. Transport and communications seem to have been the key, and the focal position of the town in the railway system, making it so accessible within its tributary area and from other parts of the North Island, assured its development as the collecting and distributing centre for the district. The steady expansion and intensification of farming in the region has reinforced the commercial and servicing roles. Short-term fluctuations in the general trend have undoubtedly occurred, caused by cyclical periods of prosperity and depression, and by the two wars, but these are largely masked by the wide spacing of census dates. Such fluctuations, however, have been very important in the development of the retail area, and are best portrayed by a study of the value of building permits issued by the City Council.

In 1929, for instance, permits to the value of £135,249 were issued for commercial building, while four years later in 1933 only one permit to the value of £1,700 was issued.[3] The more recent period of economic prosperity and the expansion of industry in the city have contributed to its growth in recent times, and while building restrictions during the second World War and immediately after delayed expansion of the retail area, much building has gone on in the last eight years. At the same time there have been more fundamental changes in the structure of New Zealand society and economy which help to explain the disproportionate growth of the larger centres in the last fifty years. Improved technology affecting the productivity of the community and the transport system, increased specialisation, the extended functions of government, and the disproportionate growth of tertiary activities in the whole economic structure, are important factors in moulding the present-day hierarchy of settlement.

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[1] Broad Street was changed to Broadway in 1926.

[2] Useful accounts of the early growth of Palmerston North can be found in: A. G. S. Bradfield: *Forgotten Days*, Palmerston North, 1956; G. C. Petersen: *The Pioneering Days of Palmerston North*, Palmerston North, 1952; T. Lindsay Buick: *Old Manawatu*, Palmerston North, 1903.

[3] A similar variation in building permits for dwellings from one hundred and forty in 1928 to fifty-four in 1933 suggests that the growth of population portrayed by census data conceals some striking short-term deviations from the general trend.

TABLE I

CHANGES IN POPULATION 1886 – 1956

Year of Census	Palmerston North	Feilding	Foxton	Shannon*
1886	2,606	1,297	—	—
1896	5,910	2,045	1,102	—
1906	10,239	2,971	1,330	—
1916	12,829	3,438	1,772	—
1926	18,134	4,258	1,696	1,109
1936	22,202	4,550	1,605	905
1945	25,277	5,001	1,651	922
1956	35,607	6,778	2,526	1,188

*Shannon became a borough in 1918.

The cumulative effect of this general trend has been to bring about significant changes in the central area.[4] First, an overall expansion of the central business area has taken place into what were formerly residential areas. In some cases this has led to a depression in the value of remaining residential properties, particularly where industry has been established. Meanwhile, the population of the central part of the city has declined, and has undoubtedly changed in character with the conversion of larger houses to flats, the tendency for the aged to remain, and the tendency for owner-occupiers to sell first. Second, an expansion of industry, particularly of the servicing type, and more especially of the type servicing motor vehicles, has taken place in the last forty years in the area adjoining Rangitikei Street and near the railway. Third, important changes have occurred in the structure of the retail system.

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[4] In tracing changes in the retail area, reliance has been placed largely on data gleaned from post office street directories for selected years. In addition, two surveys, one of the development of Main Street, and the other of the development of Rangitikei Street, carried out in 1954 by second-year students of the Department of Geography, Victoria University College, provided some useful points.

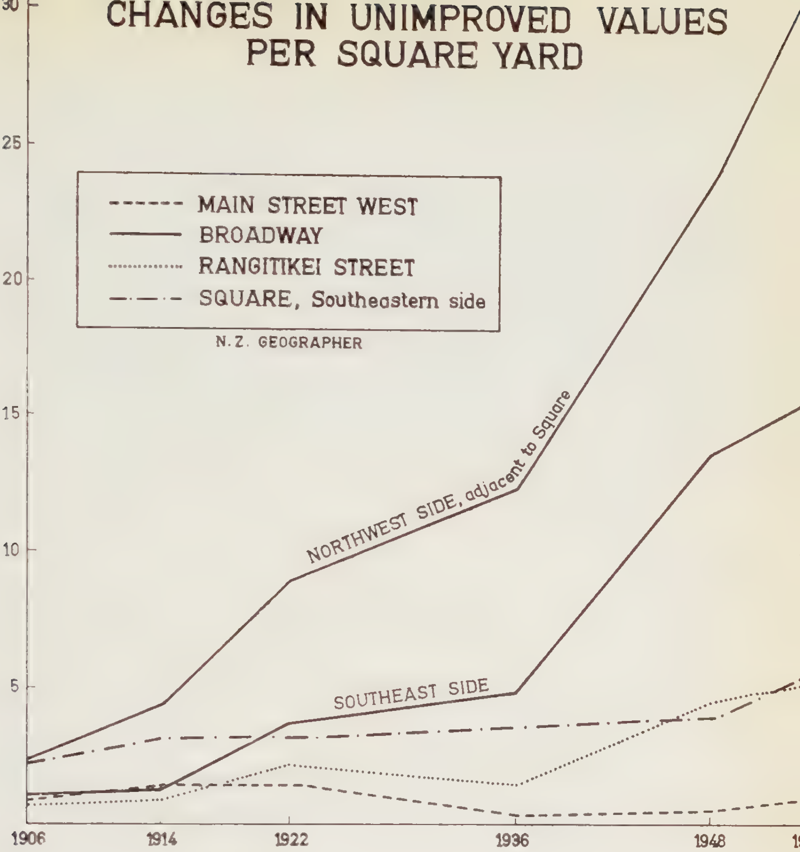
There has been a tendency for shops to become more and more specialised in the type of goods they handle. The general store has disappeared from the centre, though in a sense it has been replaced more recently by large department stores and by chain stores. The appearance of these establishments is important, for in their scale of operation and in their business and financial organisation they represent a significant progression in the development of retailing. Both this increased specialisation and the development of the department stores have in turn enhanced the retail character of the city at the expense of the nearby towns and villages. At the same time, changes in technology have been reflected in the appearance of new kinds of merchandise and the emergence of new establishments to supply them. Radio and electrical shops and automobile dealers are obvious examples. Meanwhile, for similar reasons, other merchandise and other shops have disappeared. More recently a number of specialised establishments have appeared, reflecting more particularly a long period of prosperity and of changes in fashion. Recent examples are the three espresso coffee bars which have appeared in the centre.

Changes have also taken place in the character and importance of certain sections of the retail area (*Fig.* 3). These can best be exemplified by reference to the rather chequered history of Main Street West, to the development of Rangitikei Street—the farmers' street—and to the recent emergence of Broadway as the retailers' Eldorado.

MAIN STREET

The transference of the railway from the Square to its present site in 1899 was clearly to have a profound effect on Main Street itself, at this stage almost completely undeveloped. The street was cut into very small sections, some with only fifteen-foot frontages, apparently calculated to attract people with little capital. In the next few years the street was steadily developed with a distinctive pattern of small, wooden, single-storeyed shops together with a number of hotels and guest houses catering for travellers. The railway at this stage was a very

Fig. 3.
Changes in property values*



important link between the tributary area and the town, and many people used the regular local services. All these people now passed along Main Street to the Square, and the kind of services that appeared here catered for the passing pedestrian traffic without really competing with the established shopping centre in the Square. By 1914, which was really the peak so far as Main Street was concerned, there were twenty-one food retailers between the station and George Street (six of them restaurants), five craftsmen (mainly boot repairers), and seven establishments providing other personal services.

The next few years brought vital changes which affected the character and future of Main Street West. The most important

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*The unimproved value of commercial properties is a useful index of the change in standing of different parts of the central area. Unimproved values of commercial properties are assessed by the Government Valuation Department on the basis of the following criteria: (i) the amount of pedestrian traffic passing the property over a period of time; (ii) the rents being paid by tenants; (iii) the selling price of properties in the area.

The graph of the values of selected properties in the retail area shows clearly the type of change that has been described in the development of Main Street West, Rangitikei Street and Broadway. The Main Street property has not yet regained the value of 1906, despite the recent recovery, and the effect of the release from Land Sales control in 1951 is evident.

Main Street
West

Fig. 4. Small shops in Main Street West. These shops have recently been redecorated and their fronts improved

development was undoubtedly the growth of motor transport, and the opening of the first rural bus service in 1922 spelled the end of the railway as a link between town and region, and, consequently, presaged the decline of Main Street West as a prosperous street of small shops. The earliest sign of change was the appearance, abou 1914, of a licensed dealer. Throughout the 1920's and the depressio years the status of the street declined until, by 1938, it had reached its nadir. At this stage there were at least seven shops empty, a further two used as residences, and no fewer than five licensed secondhand dealers in the street. Property values had declined abyssmally and property owners found it difficult to let shops at any price. (See Figure 3.)

Little change took place until 1948, since when the street, enhanced by the general economic prosperity of the community, has shown signs of a limited development which has been reflected in some improvement of values. At present it is occupied mainly by small food shops, dairies and restaurants, many of them attracting custom out of normal trading hours, together with a number of small hardware shops. Two licensed dealers remain in the street. The main barriers to redevelopment are undoubtedly the railway itself and the hopelessly small sections, which would require amalgamation before the replacement of the now dilapidated wooden shops was worthwhile.

Rangitikei Street

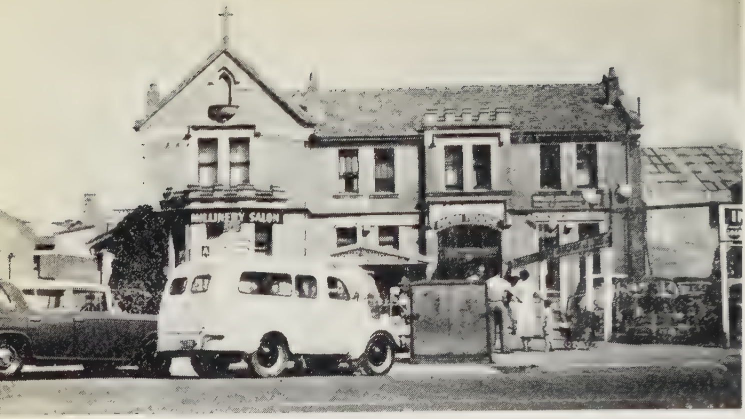
The development of Rangitikei Street as a retail area is closely linked with that of the farming district, and with the technological changes that have transformed economy and life in New Zealand. The

RANGITIKEI STREET

Fig. 5. Large office buildings, dealers in hardware and machinery, and car salesmen in Rangitikei Street

street has notable advantages which have encouraged the development here of a distinctive retail area. It provides the most important access by road from the greater part of the Manawatu lowland. It is wide, and provided ample parking, at least until the last few years. The southern sector has further advantages which help to explain the more complete development of this side. For a considerable distance there are no intersections to hinder pedestrian movement. Furthermore, the block is narrow, and it is possible for many firms to have rear entrances from Taonui Street. On the other hand, the north side of the street is hampered by the number of intersections to be crossed in walking from the Square, by the lack of rear access to most of the properties, and, more than anything else, by the fact that a large area is held as Maori Trust land and another section by the Church.

The pattern of retail services that has evolved no doubt springs from the early location here of saleyards operated by a merchandising firm which specialised in farm supplies. These yards, established in the 1890's, were also used by other stock and station firms which opened businesses in the street. They were shifted out to the edge of the city about 1911 and were later still closed down, but by this time Rangitikei Street had become a farmers' street. As early as 1900 there were three stock and station agencies, and these undoubtedly set its character. By 1924 the pattern was more clearly emerging. As well as the early firms there were now six firms handling general machinery, and two others supplying milking machines. Two other important developments were becoming manifest. Firms associated with the growing road transport system were appearing in the street, and in addition to a bus depot



Broadway
—Old Style

Fig. 6. A relic of past land use in Broadway. A former nunnery now houses offices and shops

there were five garages and three other associated servicing industries. The other development was the increase in the number of offices in the area nearer the Square, where three banks took over sites shortly after the war and built multistoreyed buildings, while a fourth bank, already in the street, enlarged its premises at the corner of Rangitikei and Cuba Streets by the addition of three storeys. Finally, at th Featherston Street end, a small shopping centre mainly comprising food shops, had developed to serve the residential area.

THE FARMERS' STREET

Since then there has been a steady consolidation of this pattern of farm supplies and machinery, transport services, and offices. However, changes in the last few years suggest that this pattern is by no means a stable one. Two firms dealing in heavy machinery have moved out of the street, one of the buildings being taken by a fourth stock and station firm, and the other by two milking-machine firms, bringing the total of these to seven. Some of the transport firms have moved—a bus depot and motor garage to Princess Street, while another motor garage has a section in the same street.

On the other hand, in common with arterial streets fringing the central area of most towns, Rangitikei Street since the war has acquired a number of secondhand-car dealers, most of them using open sites on Maori land on the northern side of the street. At the same time there has been a further increase in the number of offices in the street, particularly as the result of the erection of a multistoreyed building by an insurance firm in the late 1920's. This trend is certain to continue, for at present there are two further multistoreyed buildings under construction.

The other notable change has been in the food shops and other retail establishments. A number of the food shops near Featherston Street have disappeared—an index of the increasing accessibility of the central area and of the declining residential population in this part of the city. This trend may be checked, however, with the opening of a branch post office and a branch of a major bank in this area during the last few months. At the same time a scattering of food, clothing and other firms has appeared, particularly nearer to the Square—a trend which might continue.

BROADWAY

Meanwhile, the northwestern side of the Square continued to act as the focus of the retail area, for the motor vehicle strengthened its position, the majority of shoppers now entering the Square by Broadway or by Rangitikei Street. Expansion to the west was inhibited by the narrowing of Coleman Place and by the rather narrow George Street. Instead, development began to take place, particularly after 1920, along Broadway from the Square into what had been residential and Church property. The expansion has been a cumulative process, so that today, though gaps remain nearer Princess Street, Broadway has become the centre of the retail area, lined on both sides with shops of a considerable variety, but with a concentration of clothing and mercery shops.

Fig. 7. Broadway near the Square. The width of the street and the heavy traffic are apparent

BROADWAY
—NEW STYLE

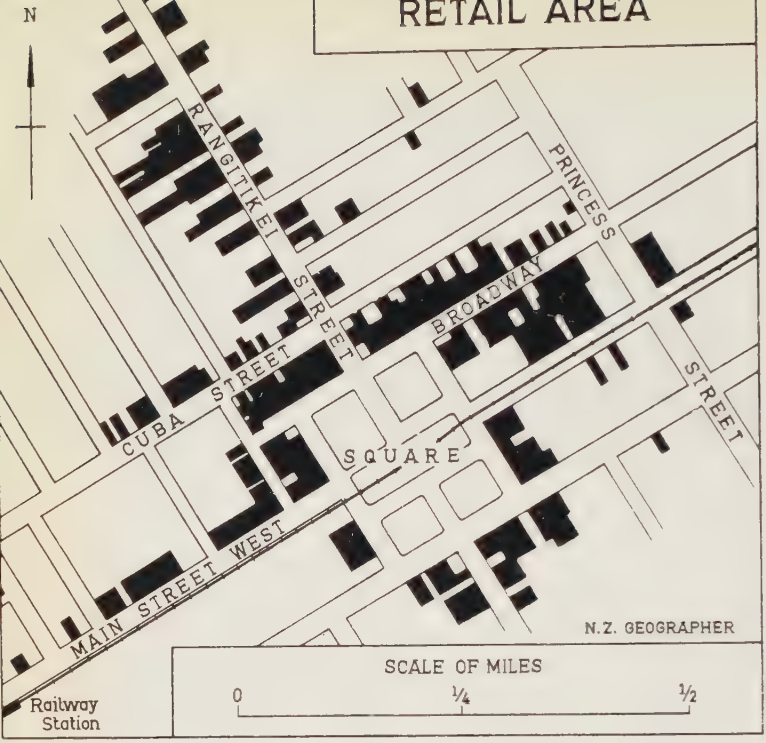


Fig. 8. The retail area of Palmerston North

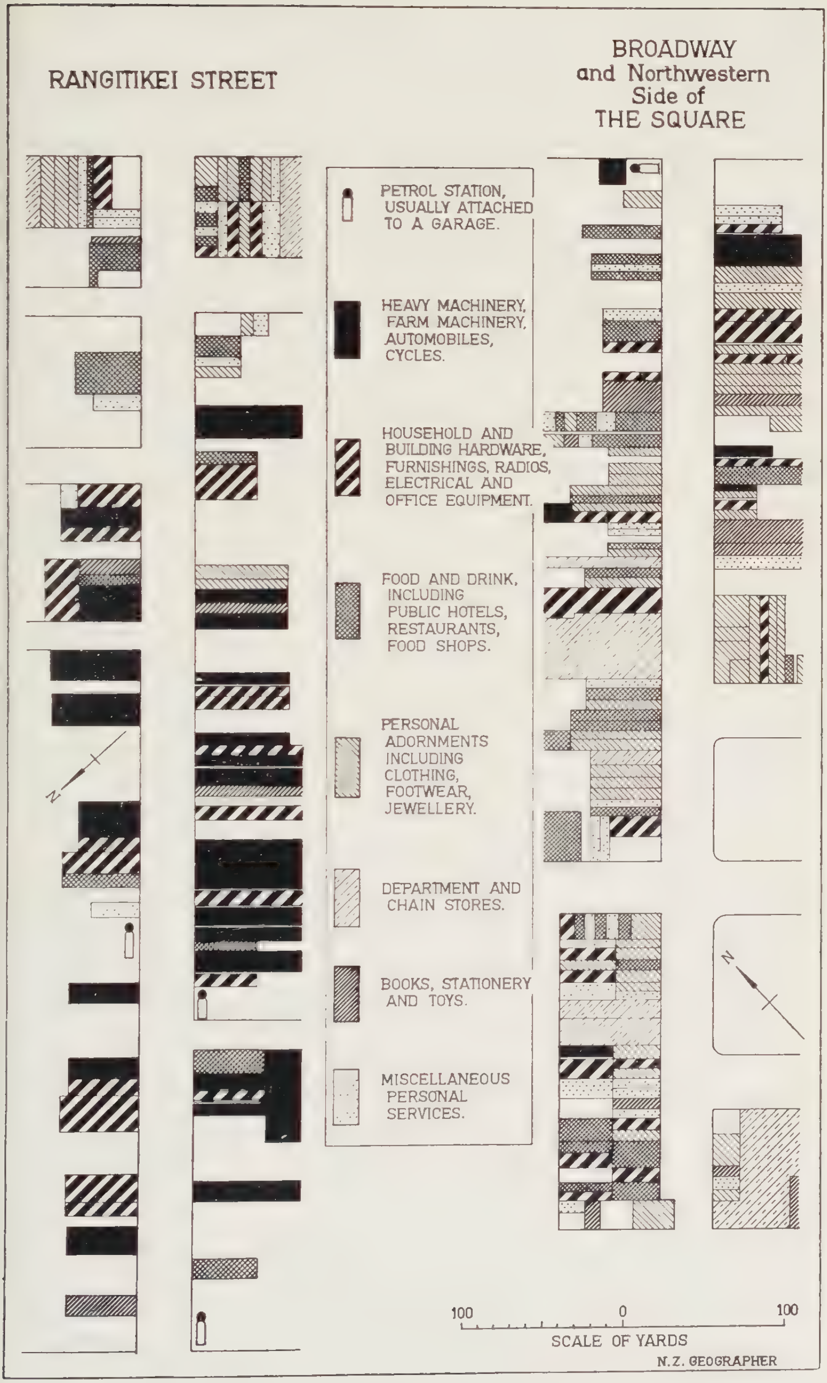
The Present-Day Retail District

The previous analysis of the development of the three streets, together with an examination of the maps of the retail section (*Figs.* 8 and 9), brings out three points:

a. The retail area has failed to conform to the symmetry suggested in the original plan. The Square was initially the centre, but expansion to the northwest along Rangitikei Street and northwards along Broadway has distorted the pattern. This deviation may be ascribed to a number of factors, the most important of which are first, the underlying question of accessibility which has helped to give Rangitikei Street and Broadway their prominence in the motor car age; second, the *laissez-faire* attitude that has prevailed in New Zealand society in regard to land use; and third, the New Zealand system of freehold ownership of land.

b. The retail system pre-empts the most accessible positions in the central area. This fact effectively underlines the importance of retailing in the highly-commercialised society of New Zealand.

c. The most impressive, and possibly the most important, feature of the retail area is the specialised nature of some of its streets. Even a cursory examination reveals the concentration in Broadway and


RANGITIKEI STREET
BROADWAY and Northwestern Side of THE SQUARE
PETROL STATION, USUALLY ATTACHED TO A GARAGE.
HEAVY MACHINERY, FARM MACHINERY, AUTOMOBILES, CYCLES.
HOUSEHOLD AND BUILDING HARDWARE, FURNISHINGS, RADIOS, ELECTRICAL AND OFFICE EQUIPMENT.
FOOD AND DRINK, INCLUDING PUBLIC HOTELS, RESTAURANTS, FOOD SHOPS.
PERSONAL ADORNMENTS INCLUDING CLOTHING, FOOTWEAR, JEWELLERY.
DEPARTMENT AND CHAIN STORES.
BOOKS, STATIONERY AND TOYS.
MISCELLANEOUS PERSONAL SERVICES.
N
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SCALE OF YARDS
N.Z. GEOGRAPHER

Fig. 9. Types of shops on Rangitikei Street and on Broadway and the northwestern side of the Square on the northwestern side of the Square of shops concerned with the sale of personal adornments—clothing, footwear and jewellery. In Broadway one third of the shops is of this type, and in the northwestern side of the Square forty-two percent are of this type. Away from this area, the proportion falls. On the southeastern side of the Square such shops comprise twenty-seven percent, and in Rangitikei Street only five percent. Another street of specialised character, of course, is Rangitikei Street where thirty-two percent of the establishments sell farm machinery and motor vehicles, and twenty-eight percent sell hardware, furnishings, office equipment and timber. Main Street East also shows a high degree of specialisation with half the retail firms selling hardware, furnishings and radio and electrical equipment.

No completely rational explanation can reveal the underlying causes of this striking areal differentiation of retail types. However, it is a sufficiently common characteristic of the larger New Zealand cities, and, in fact, of most Western cities, to warrant analysis. Firey,[5] in studying the retail district of Boston, related the pattern to the underlying 'contractual value system' of Western society, which, among other things, 'implies an open class system with a great deal of vertical mobility' and 'the assignment of status to persons in terms of their achievements'.

IMPLICATIONS OF SPECIALISATION

Two typical features of a contractualistic society which he recognises are *standardisation* and *fashion domination*. There is, on the one hand, a constant process of change in certain status symbols brought about by the desire of the elite to emerge, while on the other there is a constant pressure upon the rest of the community to conform to their standards. These two features, seemingly contradictory, are expressed in the pattern of specialisation that has been noted in the retail centre. The concentration of shops selling personal adornments in the most accessible area is related to the fact that clothing is significant as a status symbol. It is not only of relatively short durability, but is also subject to frequent fashion change and subsequent standardisation, which ensures a high turnover, and this makes the central area with its high pedestrian density attractive to these stores, despite the higher rents. Since these items are also of low to medium cost in relation to total income, the decision to buy is not such a serious one, and the attractive presentation of goods in frequently-changed displays becomes an important feature of these shops. Shops which sell goods of less importance as symbols, less subject to fashion change, or those the cost of which is greater in relation to income, will tend to be located further away from the area of highest accessibility where rents are lower. At the same time there is an obvious tendency for similar types of shops to group. This no doubt reflects the fact that shops handling similar goods have an added attraction to shoppers if they are located in close proximity to each other, so enabling prospective buyers to make a comparison of the costs and quality of goods before making a purchase.

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[5] Walter Firey: *Land Use in Central Boston*, Cambridge, 1947, Chapter VI. Here he examines the pattern of the retail centre and relates it to the underlying contractualistic social relationships. See in particular pp. 254 and 255.

Conclusion

From the study of the development of the retail area of Palmerston North, and of some of its contemporary features, the following observations can be made. First, the retail area in its evolution has reflected significant changes in the social and economic organisation of the community that supports it. The effect of changing technology has been stressed. Its direct effect has been exemplified in the history of Main and Rangitikei Streets. The more subtle effects have been touched on in noting the overall changes that have taken place in the retail system, while the significance of transport, first the railway and more recently the motor car which has impinged on almost every phase of New Zealand life, has been stressed. Second, the analysis of the present-day pattern of the retail area brings out some underlying features of New Zealand society which help to explain it.

The underlying concept, then, that this study elucidates is that settlement, being a 'tool' of society, portrays important features of the community. Palmerston North, in its recent history reflects a great deal of the dynamic nature of New Zealand society. Changing technology, changing economy and changing values are all expressed in the pattern of the retail system of the city. The concept, although it remains a serious oversimplification, has value in throwing light on the real nature of towns and cities in New Zealand, for an appreciation of settlement can come only through an understanding and awareness of the cultural milieu that has produced it.

MARKET GARDENING IN METROPOLITAN AUCKLAND*

DONALD T. HUNT

IN RECENT YEARS town planners and laymen alike have become increasingly aware of, and often alarmed at, the sprawling growth of metropolitan Auckland. With the phenomenal increase of the population and the unplanned sprawl of the urban area, particularly of dormitory suburbs, much valuable and highly-productive market-garden land has gone out of production—in the last fifteen years, several thousand acres on and about the Auckland isthmus. Until 1940 these areas had supplied the bulk of the fresh vegetables required by metropolitan Auckland. It has been said that the loss of market-garden land through urban sprawl on the periphery of Auckland city will create a vegetable shortage. However, it appears that there is ample potential market-garden land within the Auckland metropolitan area, especially in the Franklin county, to make good the loss.

LAND COMPETITION

The most conspicuous feature of the land use in metropolitan Auckland is the extensive area occupied by purely urban forms, for an almost continuous urban agglomeration sprawls over an area of some 200 square miles. Nearly all the available land on the Auckland isthmus is now built up. This can be attributed in part to the rapid growth of population, and in part to the almost universal desire for a quarter-acre section on which to build a house. Thus urban development is engulfing highly-productive agricultural land as houses and their accompanying shops and factories mushroom amongst the market gardens, town-milk supply farms and orchards.

The first sizeable encroachment on market-gardening land for urban purposes took place at Tamaki-Panmure-Mount Wellington in the early 1940's. In nineteen years West Tamaki has become one of the largest state-housing settlements in New Zealand, whilst the broad base of Mount Wellington carries Auckland's new manufacturing area.

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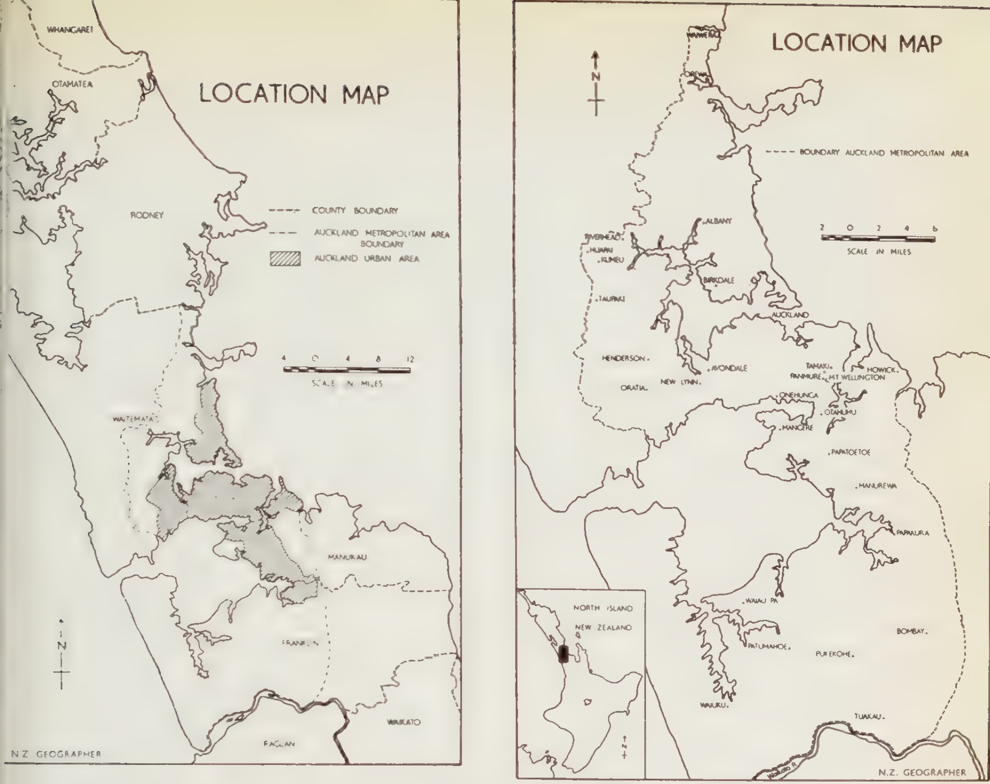
*'Metropolitan' as used in this article refers to the area defined by the Auckland Regional Planning Authority, but extended southwards to the Waikato River, the proposed future boundary of the authority, and eastwards to the margin of the hill country of the Hunuas. (See *Fig.* 1.)



Figs. 1a and 1b. Counties and localities in Metropolitan Auckland

Within a few years the highly-productive, intensively-cultivated, green patchwork pattern of Chinese market gardens was transformed into a 'wilderness' of wood and tile, and of steel and mortar—forests 'where nothing grows . . .'[1] Since 1940 more than 600 acres of vegetable land have gone out of production.

Other districts have not been immune from the march of urbanisation. On the Avondale flats, post-primary and intermediate schools, a sportsground and state houses have all been established on market-garden land bought cheaply by the state. Since 1940 at least 200 acres have gone out of production. On Pukekohe Hill, housing estates, a maternity hospital, a school for Maori children and a reserve for a future school have all occupied land on the very favourably situated north and northeast slopes of the hill. Yet during recent years the total registered acreage of market-garden land has altered very little. Between 1951 and 1955 there was, in fact, an increase of eight acres, from 4,946 to 4,955 acres. As Table I indicates, Tamaki–Panmure–Mount Wellington, Onehunga–Mangere, and the scattered areas from Papatoetoe to Papakura have suffered the greatest actual losses of market-garden land since 1951.

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[1] S. Snaith: 'To Some Builders of Cities', *Feet on the Ground*, London, 1946, p. 10.

The most spectacular increase in acreage has occurred in the extreme west of metropolitan Auckland in the vicinity of Riverhead and Kumeu. Unrestricted by urban development, the market-garden acreage has more than doubled, but at the expense of dairy farming. A significant increase also took place in the New Lynn–Henderson district, where a recent trend has been for more and more viticulturalists and orchardists to cultivate small patches of vegetables for sale at roadside stalls.

Although the total registered market-garden acreage has varied but little since 1951, this conceals the fact that much vegetable land is encroached upon annually and goes out of production. The loss is either offset by the development of land nearby, or by a change from dairying to vegetable production in areas further from the city sprawl.

Urban Sprawl

The hundred and five years since the establishment of the Borough of Auckland in 1851, with a population of approximately 8,000 people, witnessed the remarkable growth of a city. In 1956 the Auckland urban area contained a population of 380,412, compared with 329,123 in 1951—an increase of 15.5 percent. Within the Auckland metropolitan area, however, it is estimated that the population today exceeds 400,000, a figure which accounts for almost one fifth of the total population of New Zealand.

With the tremendous increase in the population, the city has burst its bounds and is spreading along the main routeways, and it is along these also that the remaining vegetable land lies, on or just beyond the periphery of the city. With the exception of the Riverhead and Pukekohe areas, all the market-garden land of metropolitan Auckland is within ten miles of the Chief Post Office, the equivalent of less than fifty minutes travelling time by public transport. However, the motor car, which gave the major impetus to suburban growth, halves the travelling time. Thus the closeness of the market-gardening areas to the principal employment area of Auckland city by good roads, together with the ease with which access roads can be made in order to facilitate subdivision for urban purposes, favour the transformation to an urban use. In addition, electricity and water supply are readily available throughout metropolitan Auckland, while sewer reticulation, which seldom precedes urban development, will be improved when the Auckland metropolitan drainage scheme becomes operative.

Hence it can be seen that the rural land on the present periphery of the Auckland isthmus has the basic requirements for urban development. With the increased demand for land for urban uses, many market gardeners situated on, or just outside, the isthmus have been tempted to sell their land. In some of the more intensely-urbanised or favourably-situated areas at Tamaki-Panmure–Mount Wellington, on the North Shore, in parts of Mangere, and on Pukekohe Hill, some growers have seized upon the opportunity of selling their land. On the whole, however, market gardeners seldom sell with profit-making as their motive. All the principal market-gardening districts are long-established, traditional growing areas, and market gardeners dislike seeing their land converted to an urban use. However, as urban forms of land use and urban facilities spread and gradually surround the market-gardening areas, rates become so high that retention of land for vegetable production is both impracticable and uneconomic. Some growers have sold their land and bought more at rural values further away from Auckland in the Franklin county (*Fig.* 4).

TABLE I

REGISTERED MARKET GARDENS: 1951 AND 1955*

District	1951	1955	Change
North Shore	215.5	209.5	− 6
Riverhead–Kumeu	119	289.5	+170.5
New Lynn–Glen Eden–Oratia–Henderson	100.5	189	+ 88.5
Avondale	456.5	445	− 11.5
Central City	54.5	46.5	− 11.5
Tamaki–Panmure–Mt. Wellington	627.5	514	−113.5
Onehunga–Mangere	1353.5	1243	−110.5
Otahuhu	153.5	195	+ 41.5
Papatoetoe–Manurewa–Papakura	181.5	127.5	− 54
Pukekohe–Bombay and Environs	1685	1696	+ 11
Totals	4947	4955	+ 8

*Areas in acres

LANDFORMS AND SOILS

The landforms of metropolitan Auckland present few difficulties for the market-gardening industry, which in the major districts makes use of slopes which are orientated to the north or east. The surface configuration may be described as gently rolling. Slopes are not very steep and approximately half the area of metropolitan Auckland has slopes of less than five percent.[2] For the rest, about one third of the land has slopes between five and ten percent, while only one sixth is characterised by slopes greater than ten percent. The steeper slopes are found mainly to the north of the Waitemata Harbour, to the west of the isthmus at the foot of the Waitakeres, and in the east in the hill country of Bombay and on the margins of the Hunuas.

Market gardening is usually found where the local relief is less than 300 feet. However, large areas of vegetables are grown at heights of more than 600 and 800 feet, on the Pukekohe and Bombay Hills respectively, where the average slope is in excess of eight percent. Gently-sloping or flat land is desirable for market gardening as it permits the maximum use of machinery.

IMPORTANCE OF ASPECT

Probably the most important feature about slopes in relation to market gardening is their orientation. Practically all the areas which grow vegetables commercially are inclined either to the north or to the east. These slopes are warm, and the soil receives a maximum of solar heat throughout the year. Pukekohe Hill is the only place where there are well-defined *adret* and *ubac* slopes, although the southeastern slopes of Mangere mountain receive little afternoon sun. The *ubac*, or southern, slopes of Pukekohe Hill are colder and steeper, and as a result there is a marked local difference in the harvesting dates when compared with northerly or easterly slopes.

Vegetables, to be grown successfully, require good natural drainage, and slopes on most market gardens are usually sufficient to prevent drainage problems. On the other hand, excessive slopes often present difficulties because they limit the use of machinery and the rain gradually washes the best soil down the slopes. Market gardeners on Pukekohe Hill take steps to prevent this type of erosion. Instead of working the land to a very fine tilth as at Mangere, Panmure and on the Avondale flats, it is left coarse after ploughing. Prior to the planting of each crop, the slopes are crossdrained every chain. 'Gardeners' have found that by using these methods soil creep is checked.

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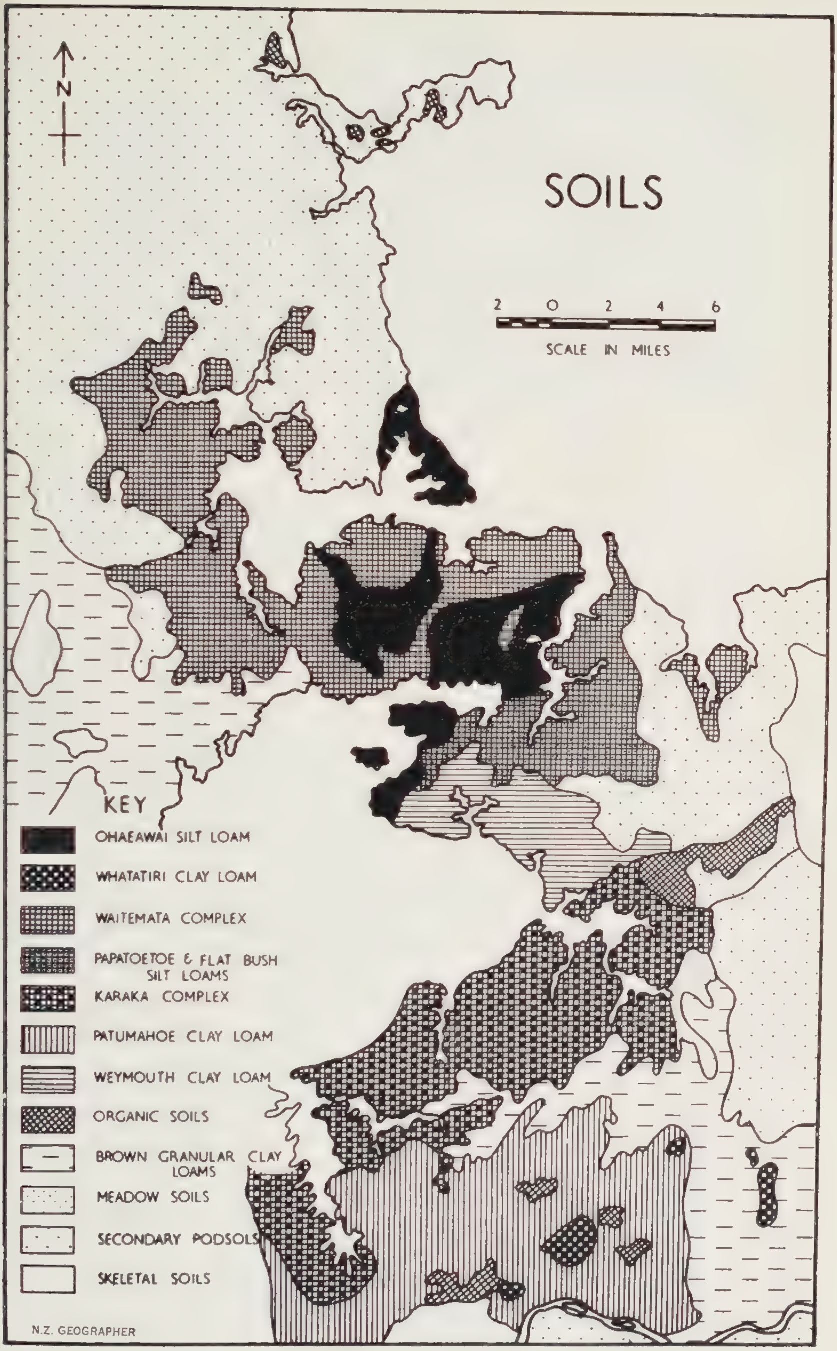
[2] See map in Auckland Metropolitan Planning Organisation: *Outline Development Plan for Auckland*, Auckland, 1951, p. 66.



N.Z. GEOGRAPHER

Fig. 2. Soils of the Metropolitan Auckland Area

Metropolitan Auckland is characterised by a wide variety of soil types, but market gardening is confined almost exclusively to loam soils, although isolated and small patches do occur in areas of better podsols and of organic and recent alluvial soils (*Fig. 2*).

Within the Yellow-Brown Loam subgroup are four soil types on which market gardening is regularly practised. The Waitemata complex, as a whole, is not inherently fertile and is generally deficient in phosphates and lime. To the east of the Tamaki River, and to the south and southeast of the Manukau Harbour, are the Papatoetoe and Flat Bush silt loams. These two soil types have a clay horizon which prevents good natural drainage. The areal extent of the market-gardening land on these two soils is not great, but it includes Otahuhu with its emphasis on glasshouse tomatoes, and portions of eastern and northern Mangere where artificial drainage is extensively used. In the Karaka complex, found in the Franklin county, the clay horizon just underlies the topsoil. Because of the pugginess of the soil in the winter months, it is characteristic to find very few crops grown. On this soil type it is mainly the dairy farmer who grows vegetables as a sideline to rejuvenate the soil for pasture growth.

The Brown Granular Loam and Clay subgroup has three types on which market gardening is developed. The Weymouth clay loam is fairly fertile and is distinctive because of its lightness. It dries out very rapidly in summer and salad crops require copious artificial watering. The Patumahoe clay loam, which occupies an extensive area in the Franklin county to the north of Pukekohe Hill, is naturally very fertile. Based as it is on basaltic parent material, it holds the moisture well and natural drainage is adequate enough to prevent waterlogging of the soil in winter. In all respects this type is most suitable for the growth of fresh vegetables.

Of prime importance to the market gardening industry is the Red-Brown Loam subgroup. The soils are derived not only from the weathering of scoria, but also from the ash ejected by the many local centres of eruption within the Auckland metropolitan area. The Ohaeawai silt loam is very friable and can be cultivated immediately after rain. It dries out very rapidly in summer, and even in winter, and so makes necessary the artificial watering of crops by means of sprinkler systems. In parts of Mangere, Ihumatao, Panmure and Onehunga, care has to be taken when cultivating implements are being used, as scoria and rock outcrops often lie close to the surface.

Fig. 3. Hedges and shelterbelts on Pukekohe Hill. Indian boys harvesting immature onions for the early spring market

The Whatatiri clay loam is found on the Pukekohe and Bombay Hills. The soil breaks down to an excellent tilth under satisfactory moisture conditions. With heavy rain in winter and spring, however, the underlying basalt sheet impedes drainage to such an extent that the soil becomes saturated, sticky and puggy, making cultivation difficult.

Although the Red-Brown Loams have the highest natural fertility of all soils on which vegetables are grown in metropolitan Auckland, they require regular and liberal applications of fertiliser to maintain the high production associated with a continuous and heavy cropping programme.

WEATHER AND CLIMATE

The whims of the weather pose many difficulties for the commercial gardener. It is not the annual average rainfall nor the annual average temperatures which present problems, but rather the weekly and daily extremes of weather reflected in wind, frost, temperature, rainfall and sunshine conditions.

Normally, wind does little serious damage to market-garden crops. In the Auckland area the wind blows more frequently from the south and west, than from any other direction, and it is characteristically fresh and cold. It is usual for most areas which are exposed to the south and west to have shelterbelts of lawsoniana (*Cupressus lawsoniana*) or macrocarpa (*Cupressus macrocarpa*), or to have hedges of barberry (*Berberis vulgaris*) along those boundaries. Sometimes salt spray carried by southerly and westerly winds seriously burns vegetables in Mangere and on Pukekohe Hill. Yet most 'gardeners' would rather have the cold winds from the south and west than the warm humid breezes from the north and east because these encourage the spread of blight and the breeding of insect pests. The vegetables most susceptible to damage by strong winds are the pumpkin, pea, bean and tomato crops.

Frosts are not a serious problem in normal years, but on occasions their incidence may be disastrous, not only to outdoor growers, but also to growers with unheated glasshouses. Riverhead, the Avondale flats and the southern portions of Mangere appear to have more frequent frosts than elsewhere, whilst those areas most notable for their freedom from frosts are the Pukekohe and Bombay Hills. Where frosts are more prevalent, crops such as potatoes and pumpkins are planted much later, the latter often under protective hot-caps. On cold nights, owners of unheated tomato glasshouses attempt to protect their crops by placing kerosene heaters at regular intervals among the plants.

Temperatures are normally mild with no great extremes, the mean temperature range being only 14.75 F. However, mild temperatures combined with a high average relative humidity of seventy-nine percent present conditions which favour the spread of vegetable diseases. Mildews, blights, aphis, caterpillars and other insects can do considerable damage to most crops unless sprays and insecticides are continuously applied.

The annual average rainfall figure for the main meteorological stations of metropolitan Auckland is 52.5 inches. The rainfall is spread fairly evenly throughout the year, with a distinct winter maximum. However, the rainfall is generally sufficient for market-gardening requirements. Nevertheless all salad crops require abundant moisture, and at all times when rainfall is deficient sprinkler systems must be brought into operation.

'It has been found that intensity of light and the total hours of bright sunshine are major factors in successful tomato [glasshouse] production tion . . .'[3]. This is true of all vegetable production. The sunshine hours for Auckland are not as high as those for Nelson or Napier,[4] but they are adequate for heavy crops of tomatoes in glasshouses and generally out of doors, and since most of the indoor and outdoor areas of market

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[3] S. O. Gillard: 'Growing Tomatoes in Glasshouses', *N.Z. Dept. of Agric. Bull. No. 370*, Wellington, 1954, p. 3.

[4] Average sunshine hours: Nelson 2,501, Napier 2,451, Auckland 2,059.

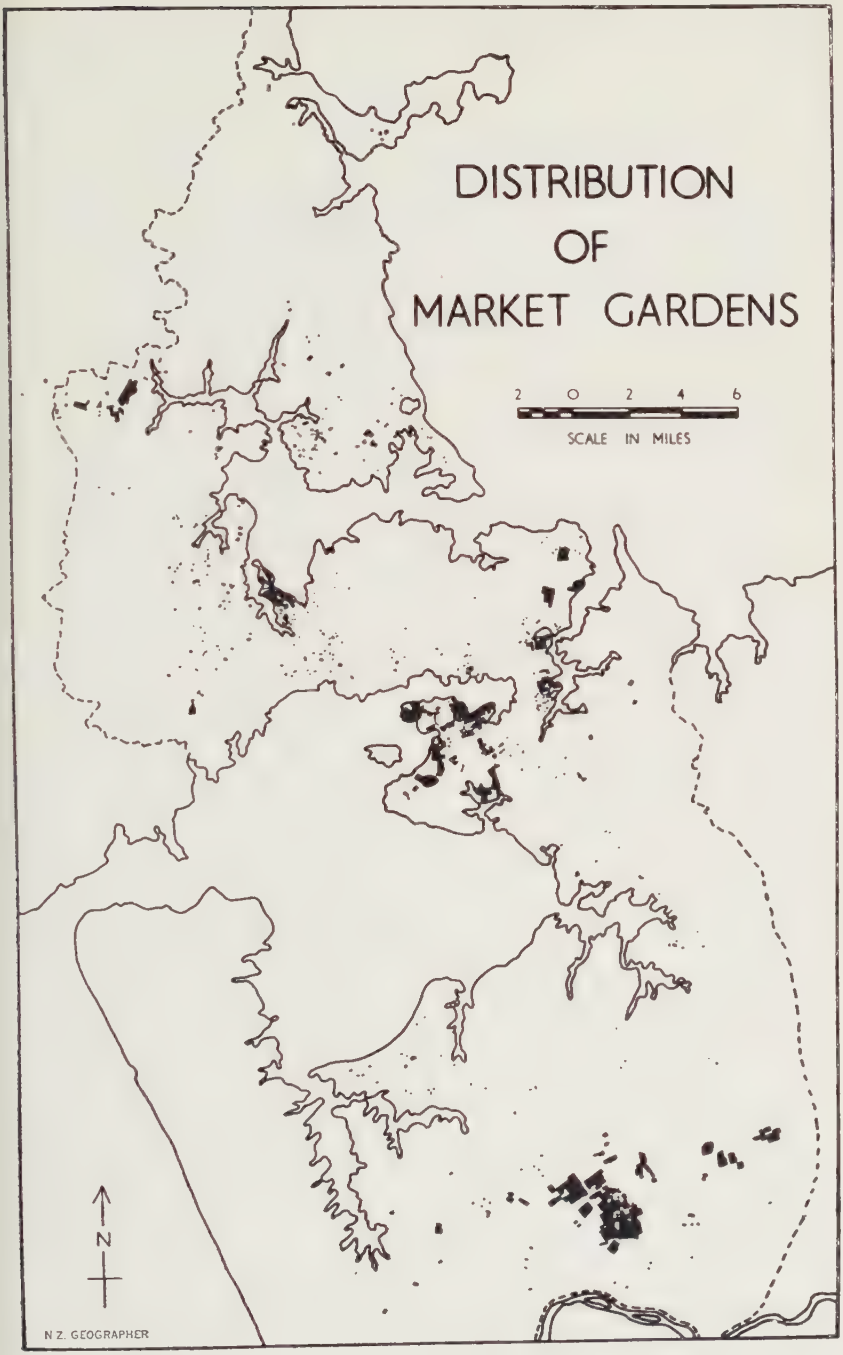

Fig. 4. Distribution of market gardens in the Auckland Metropolitan Area gardening are situated on slopes facing north or east, tomatoes, as well as all other crops, can receive the maximum daily benefit from the sun.

DISTRIBUTION AND SIZE OF MARKET GARDENS

Within the 628 square miles of metropolitan Auckland, a total of 660 commercial market gardens, occupying an area of 4,955 acres, were registered with the Department of Agriculture in 1956. This area included more than 327 acres under glass,[5] but did not include land growing onions, potatoes, kumaras, swedes and turnips. This latter area accounted for an additional 1,982 acres. Hence, in 1956, 6,937 acres were devoted to the growing of fresh vegetables within metropolitan Auckland.

The distribution of market gardens is very uneven, but the greatest concentration is to be found to the south of the Auckland isthmus in the Manukau and Franklin counties (*Fig.* 4). These counties have about thirty-three and forty-four percent respectively of the total vegetable acreage. It is significant that, when taken together, the Onehunga–Mangere and Pukekohe–Bombay areas contain sixty-five percent of the market-garden land of metropolitan Auckland.

The size of registered market gardens varies from half an acre to 170 acres, while the average acreage is seven and a half. As Table II indicates, the relatively small size of holdings is borne out by the fact that two-thirds of all registered 'gardens' are less than five acres, with fifteen percent between five and ten acres. Holdings in the Pukekohe, Mangere, Tamaki, Avondale and Riverhead areas are typically larger than elsewhere. Where glasshouse cultivation is established and not combined with outdoor market gardening the holdings are small, but two and a half acres of land under glass may produce the equivalent of twenty acres of fresh vegetable crops outdoors. The average size of a glasshouse holding is about two acres, with an average area of 6,300 square feet under glass.

Fresh vegetables for sale commercially are not always grown on 'pure' market gardens. In some areas such as Henderson, Oratia, Avondale and Otahuhu, vegetables are grown as an adjunct to viticulture or in combination with general orcharding. On the whole the area devoted to vegetables is small. Crops such as pumpkins and marrows are sometimes grown between the grape vines and fruit trees, or are utilised for filling vacant space. The fresh vegetables are usually sold directly to the public, and only the excess is sent to the market.

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[5] 5,000 square feet under glass is considered to be the equivalent of one acre outdoors in terms of production.

The dairy farmer who grows vegetables does so in a planned rotation to help to keep pastures in good condition. Peas are the major crop, although beans, pumpkins, cabbages, cauliflowers, carrots, turnips and swedes are also grown. In metropolitan Auckland during the 1955–1956 season, there were approximately 950 acres of peas grown by some 140 pastoral farmers under contract to processing firms for either canning or freezing. The most important pea-growing areas are to the south of the city in the vicinity of Manurewa, and in the Franklin county.

TABLE II

SIZE OF HOLDINGS: REGISTERED MARKET GARDENS

Acres	No. of Holdings	Percentage Total Holdings	Total Acreage	Percentage Total Acreage
Less than 1	144	21.8	127	2.6
1–5	295	44.7	858.5	17.3
5–10	100	15.5	702.5	14.2
10–20	76	11.2	1095	22.1
20–40	31	4.7	902.5	18.2
More than 40	14	2.1	1270.5	25.6
Totals	660	100.0	4955	100.0

‘PURE’ MARKET GARDENING

The ‘pure’ market gardens are much more important than the mixed market-garden units. A great variety of crops is grown outdoors, and certain areas are noted for the growing of particular crops. The Pukekohe district has for many years been one of the leading vegetable-producing areas in New Zealand and, in particular, of early potatoes and onions. It is estimated that during the season 1954–1955, 1,389 acres of potatoes were grown in metropolitan Auckland, and of these, 794 acres were in the vicinity of the Pukekohe and Bombay Hills. Of the 593 acres under onions during the same season, all but fifteen acres were grown in the Pukekohe and Bombay districts. Onions, like

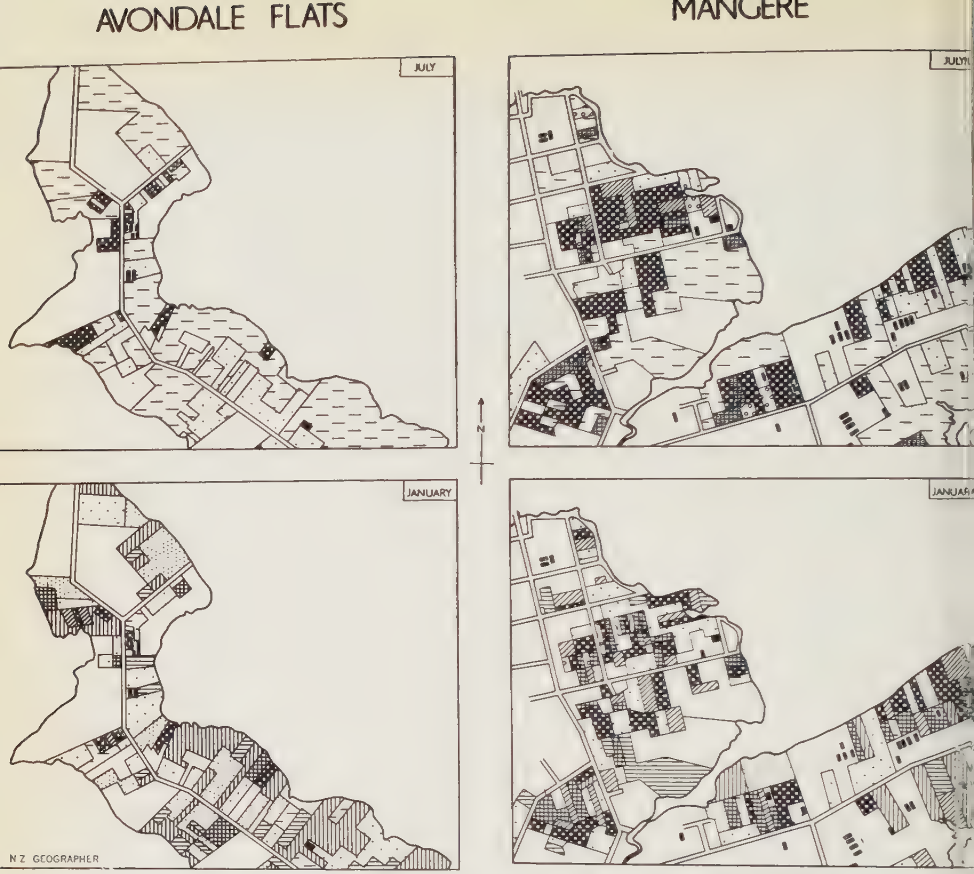

Fig. 5. Seasonal variations in market-garden crops on the Avondale flats and at Mangere
(For key see Figure 6.)

potatoes, are grown more as field crops than market-garden crops in that they occupy large blocks of land (*Fig.* 3).

Mangere is characterised by the intensive growing of salad crops—lettuce, beetroot, celery, radish, spring onion, parsley and other small crops such as silver beet, spinach and rhubarb. These are typically grown by Chinese who cultivate the land in strips (*Fig.* 7). In the Tamaki–Panmure–Mount Wellington area, although a diversification in the crops grown is apparent, salad crops occupy the largest area, but dwarf tomatoes, cauliflowers, cabbages and beans are very significant.

On the Avondale flats are grown large quantities of cabbages, cauliflowers, kumaras, potatoes and early pumpkins. At Riverhead–Kumeu there is a marked specialisation in potatoes and autumn pumpkins. Other areas are characterised by a diversity of crops with a relatively small acreage devoted to each.

The production of tomatoes[6] and, to a minor extent, cucumbers

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[6] The tomato, although botanically a fruit, is considered a vegetable throughout this work.

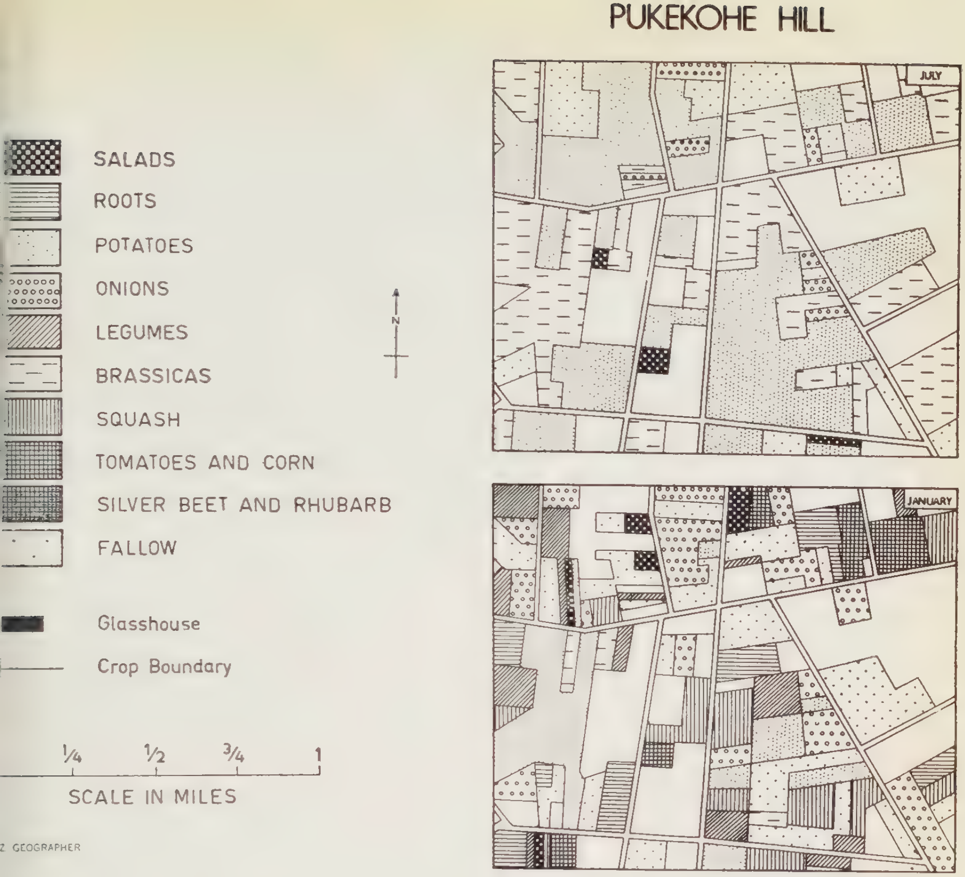

Fig. 6. Seasonal variations in market-garden crops on Pukekohe Hill

under glass has become an important feature of commercial vegetable growing in New Zealand. A survey made by the Department of Agriculture in 1950 showed that in New Zealand there were approximately a thousand commercial growers, who operated 2,200 glasshouses, representing a total area of 5,100,000 square feet. In 1956 there were 259 commercial tomato and cucumber growers in metropolitan Auckland, owning a total of 510 glasshouses with a total area of 1,635,132 square feet. The majority of the growers are European. Indian, Chinese, Dalmatian and Maori growers together account for only fifty-two glasshouses.

The greatest concentrations of glasshouses are to be found in the Avondale, Onehunga–Mangere, Otahuhu and Tamaki–Panmure–Mount Wellington areas. Glasshouse cultivation is a very intensive form of land use, especially when it is considered that on two and a half acres of land at Avondale twenty-one glasshouses are concentrated, their area being equivalent to twenty-one acres outdoors. Only twelve

Fig. 7. A Chinese market garden at Mangere. Leeks, lettuce and silver beet are being grown in strips

percent of the glasshouses are heated, but in the others, kerosene warmers are used on cold nights to prevent frost damage.

OWNERSHIP, MECHANISATION, LABOUR

In the market-gardening industry of metropolitan Auckland the bulk of the land is freehold. In general, where land is held on leasehold, Chinese are usually the lessees. Of the total number of market gardeners in metropolitan Auckland, sixteen percent are Chinese, and they work slightly more than a third of the total market-garden acreage. They are concentrated most notably at Mangere, where they outnumber the Europeans and work seventy-two percent of the total land under vegetables. Utilising mainly leased land, and knowing little about scientific land management, Chinese of the older generation tend to 'mine' the soil. The man-hours per unit area of land are very high, and yet the *per capita* yield is very low, largely because of dependence on too great a range of crops grown on very small patches.

Europeans, who represent almost three-quarters of the registered growers, work fifty-seven percent of the market-garden land. As well as this, it is estimated that they own and work at least 1,800 acres of the total 1,982 acres of potatoes and onions grown. The 'gardening' methods are extensive, typically scientific, and the market garden is as carefully run as any business concern. The Dalmatian growers are to be found to the west of the isthmus where they combine vegetable growing with viticulture or general orcharding. The Indian growers are found almost solely on Pukekohe Hill, although some have entered the tomato glasshouse industry at Otahuhu.

Today, the industry is highly mechanised and the use of horsedrawn implements is an unfamiliar sight. The large grower owns and uses as much labour-saving machinery as possible, while the small grower either hires a neighbour's implements or employs a contractor, especially for rotary hoeing and deep ploughing. The large market gardens are very suitable for the use of machinery, but on Chinese 'gardens' where strip cropping is typical, even small rotary hoes and tractors can be used only with difficulty.

The majority of market gardens have an adequate permanent labour force. The usual number of permanent employees on 'gardens' of less than thirty acres is two or three, while eight suffice on seventy-two acres and twelve on a hundred acres. The European permanent employee seldom lives on the 'garden', but has his home close at hand. At Mangere and Pukekohe, Maori employees, both male and female, are more numerous than European, and in an endeavour to make the Maori labour supply as stable as possible, market gardeners have been obliged to erect houses on their properties. The typical Maori dwelling on a European 'garden' is the ex-army hut in an excellent state of repair, while houses provided for the Maoris by Chinese growers are incredibly poor. They often consist of corrugated-iron sheds, with earth floors and primitive sanitary, washing and cooking facilities. The Maori generally likes the work on market gardens, the communal living with a minimum of responsibility—especially where several family groups are living on the one property—and the ample supply of free vegetables.

The market-gardening industry is very dependent on a large number of casual workers, mainly for the harvesting of crops. In the Pukekohe and Mangere areas, Maoris supply the bulk of the casual labour force,

Fig. 8. Glasshouse cultivation of tomatoes at Avondale. Flexible tubes carry water and liquid manure

while elsewhere, married women, pensioners, students and school children are used during the flush of the season. Potatoes, onions, peas and beans are the main crops which require a large supply of labour for harvesting purposes.

MARKET-GARDEN REGIONS: NORTH SHORE

Within the Auckland metropolitan area ten market-garden regions may be delimited (*Fig.* 9). On the North Shore the market-garden land is very scattered and amounts to only four percent of the total acreage of registered vegetable land (Table III). That part of the North Shore which lies nearest to Auckland, especially Birkdale, has the most marked concentration of both outdoor 'gardening' and tomato glasshouse cultivation. As a glasshouse area it is significant for both the number of glasshouses and the total area under glass. The soils of the Waitemata complex are poorly aerated and naturally drained. They are difficult to work in winter, but have an advantage of seldom drying out in summer, thus enabling late summer crops to be successfully grown. The crops produced outdoors are diversified and are often associated with an orchard economy. The Whangaparoa Peninsula is distinctive for the growing of autumn pumpkins to be stored during the winter. Tall macrocarpa and pine shelterbelts provide ample protection and the pumpkins are stacked under them, but where such storage facilities are not available, wooden racks are constructed. Because of the relatively small average size of holding in this region, the quantity of vegetables produced is small and does not warrant individual growers transporting their own produce to the city markets.

RIVERHEAD–KUMEU

This region is becoming increasingly important as a source of fresh vegetables, and the market-garden acreage is expanding annually, largely at the expense of dairy farms. The average size of holdings is quite large, and on the 'pure' market gardens the techniques are quite extensive. This area has some rich, heavy, peat soils which retain moisture well and which have been found conducive to the growing of late summer potatoes and autumn pumpkins. Many growers cultivate but two crops a season, potatoes in the summer and pumpkins in the autumn, leaving their land fallow during the winter. More intensive practices are found on vineyards and orchards where small plots of vegetables are grown for sale at roadside stalls.

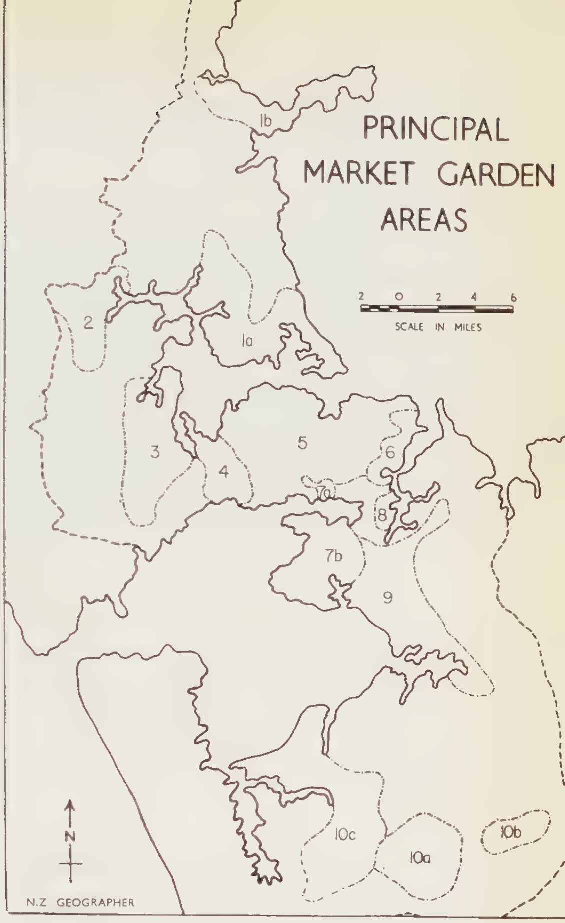

Fig. 9. Principal market-garden areas of the Auckland Metropolitan Area

1. North Shore
2. Riverhead—Kumeu
3. New Lynn–Glen Eden–Henderson–Oratia
4. Avondale
5. Central City
6. Tamaki–Panmure–Mount Wellington
7. Onehunga–Mangere
8. Otahuhu
9. Papatoetoe–Manurewa–Papakura
10. Pukekohe–Bombay and Environs

The market-garden land of Riverhead–Kumeu is characteristically hidden behind tall hedges and is surrounded by the green pastures of dairy farms. The recent development of the region as a market-garden area is reflected not only in the modern houses, but also in the modern well-kept farm sheds and pumpkin storage racks. It is also reflected in the fact that there is as yet not a single commercial tomato glasshouse.

New Lynn–Glen Eden–Henderson–Oratia

The growing of vegetables in this region is usually an adjunct to viticulture or to an orchard economy. The average size of holdings is very small, and one third of the growers are Dalmatian. The vegetable crops are fairly diversified and are designed for cash sale from roadside stalls which are very prominent at Henderson and Oratia. Tomato glasshouse cultivation is becoming more popular, but the characteristic features of this region are the trim vineyards, the lines of fruit trees, and the wine cellars and packing sheds which overshadow the scattered and pocketed vegetable land.

Fig. 10. Spring cabbages growing at Avondale

AVONDALE

This is an important outdoor and indoor market-gardening area. The average size of holdings is only seven acres, but this is inclusive of glasshouse establishments on very small holdings. The soils, derived from the Waitemata complex, are quite fertile and, with the high water table, heavy cropping programmes and high yields can be maintained without recourse to watering. The outdoor vegetables are grown in an extensive manner, the major types being cabbage, cauliflower, kumara, pumpkin and dwarf tomato. Few salad crops are produced (*Fig.* 5). The cultivating, planting and harvesting operations are highly mechanised.

From a distance, the Avondale flats, which is the major concentration of outdoor growing within the region, have a dishevelled appearance with irregularly-shaped, untrimmed trees and hedges marking property boundaries, various pieces of machinery lying out in the weather, and jumbled stacks of vegetable crates. In this, a traditional market-gardening area for over fifty years, the ensemble of structures is old, and the neatly-painted houses stand in marked contrast to the often-dilapidated tumbledown implement and manure sheds.

The tomato glasshouse industry, found throughout the area, but with a distinct concentration in Avondale South, accounts for almost one quarter of the tomato glasshouses in metropolitan Auckland, and the tomato crop is put on the New Zealand market very early. It is characteristic to find that glasshouse growers utilise carrying firms to transport their produce while outdoor growers use their own.

TABLE III

REGISTERED MARKET GARDENS: 1954–1955

Region	Acreage	Percentage Total Acreage	No. of Growers	Percentage Total Growers	No. of Glass-houses	Percentage Total Glass-houses	Glasshouse Area in Square Feet	Percentage Total Glasshouse Area	Average Size of Holdings in Acres
1. North Shore	209.5	4.1	67	10.2	53	10.4	119,470	7	3.1
2. Riverhead–Kumeu	289.5	5.8	47	7.1	—	—	—	—	6.1
3. New Lynn–Glen Eden–Henderson–Oratia	189	3.8	77	11.7	33	6.5	95,050	6	2.5
4. Avondale	445	8.9	62	9.4	127	24.9	423,830	26	7.2
5. Central City	46.5	0.9	22	3.3	9	1.8	21,480	1	2.1
6. Tamaki–Panmure–Mt. Wellington	514	10.3	39	5.9	58	11.4	184,874	11	17.0
7. Onehunga–Mangere	1,243	25.0	125	18.9	128	25.0	475,185	29	9.9
8. Otahuhu	195	3.9	55	8.3	69	13.5	229,380	14	3.5
9. Papatoetoe–Manurewa–Papakura	127.5	3.1	28	4.3	24	4.7	61,690	4	4.5
10. a, b, c, Pukekohe–Bombay and Environs	1,696	34.2	138	20.9	9	1.8	24,173	2	12.3
Totals	4,955	100.0	660	100.0	510	100.0	1,635,132	100	7.5

CENTRAL CITY AND TAMAKI–PANMURE–MT. WELLINGTON

The city area is mainly built up; consequently there is very little market gardening. The few holdings that do exist are very small and their distribution is scattered. Tomatoes grown in glasshouses are the major vegetable crop.

The region embracing Tamaki, Panmure and Mount Wellington is distinctive in that Chinese work eighty-five percent of the land, and in that the average size of holding is seventeen acres. The characteristic crops are salads, legumes, brassicas and tomatoes, grown on fertile, loamy, well-drained soils. They occupy larger acreages than is usually the case with Chinese market gardens, and the holdings are typically leasehold. The Chinese use modern machinery for the heavy work, while Maori women do the planting, weeding and harvesting by hand. The fifty-eight tomato glasshouses, all owned by Europeans, are found on slopes facing north and east, the major concentration being along the southern shores of the Panmure Basin.

ONEHUNGA–MANGERE

The Onehunga–Mangere region is second only to Pukekohe–Bombay as a producer of outdoor vegetables, but it is the most important tomato glasshouse district both in the number of houses and the area under glass. The sizes of individual holdings range from half an acre to 170 acres, the largest in metropolitan Auckland, with an average of almost ten acres. Chinese work almost three-quarters of the vegetable land, usually held on lease. They use intensive methods and a minimum of machinery; hence the application of hand labour per unit area is high. The Chinese grower specialises in the production of salad and other small vegetable crops for an all-the-year-round supply, using the strip system. The buildings on the Chinese 'gardens' are typically in a poor state of repair, and have a very untidy appearance. European market gardeners here tend to specialise in growing glasshouse tomatoes.

This region is characterised by the most intensive pattern of agricultural land use in metropolitan Auckland, and it is the major source of supply of salad crops to Auckland. The crop areas have a patchwork appearance with vegetables in varying stages of maturity, and often subdivided by hedges or rock walls (*Fig.* 6). The neat and compact glasshouse establishments stand in marked contrast to the untidy and variegated aspect of outdoor vegetable cultivation.

Otahuhu and Papatoetoe–Manurewa–Papakura

In the Otahuhu region the growing of tomatoes under glass is the main market-garden concern, and this is the third major area for both the number of glasshouses and the total area under glass. Beans, peas and small areas of salad crops are also cultivated. The market-gardening industry is gradually becoming more intensive as outdoor growers change to glasshouse cultivation—a reflection of the spread of urban forms of land use.

The Papatoetoe–Manurewa–Papakura region is characterised by scattered market gardens on which a variety of crops is grown on small holdings. Within the region increasing numbers of dairy farmers are growing peas for canning and freezing under contract to processing firms in Auckland.

Pukekohe–Bombay and Environs

Pukekohe Hill is the largest and most continuous area under market gardens in metropolitan Auckland. Including Bombay Hill and the area to the north and northwest of Pukekohe Hill, there is altogether an estimated total of 3,068 acres devoted to the growing of vegetables. Early potatoes and onions—indeed almost all vegetable crops—are

Fig. 11. A Maori family digging and bagging a crop of early potatoes on Pukekohe Hill

Photo: Sparrow Pl

grown on relatively large holdings using extensive methods. Many 'gardens' are so specialised that they grow only three crops a year: early potatoes, onions and cabbages or cauliflowers. The potato and onion crops occupy forty-eight percent of the vegetable land and the onion storage shed is a distinctive variation in the usual ensemble of structures (*Fig.* 7).

The Pukekohe and Bombay Hills are noted for their freedom from frosts and for the rich red loam soil. Potatoes may be grown the year round, except on the lower slopes. Planting begins in May and harvesting takes place in August, which is the period when frosts are fairly frequent elsewhere. There is a definite zonation in early potato planting on these two hills, and it is only the higher portions of the north and northeast slopes which are planted in May. Crops are planted progressively later further down the slopes. Nevertheless, it is not uncommon even here for three crops of potatoes to be harvested from the same piece of ground within fourteen months.

This area is almost solely the domain of the European grower, although Indians in recent years have bought some of the most favourably-orientated land on the northeastern slopes of Pukekohe Hill. The machinery and labour-saving devices employed are modern and scientific; nevertheless, a large permanent labour force and seasonal supply are necessary, Maoris constituting the majority of the labourers. Many growers are removing their hedges and shelterbelts in order not only to increase the working acreage, but also to permit the maximum efficient use of machinery and to help to reduce the frost hazard by allowing the air to circulate freely on the slopes.

Although the market gardens are more scattered to the north and northwest where farmers grow crops of peas for the canning factory, this region is distinctive in metropolitan Auckland. The Pukekohe and Bombay Hills stand like tilled oases amidst the many thousands of acres of pasture in the dairy country of South Auckland. But even here urban forms of land use are annually encroaching on some of the most valuable and productive vegetable land in New Zealand (*Fig.* 13).

The Future of Market Gardening

Market gardeners are apprehensive at the prospect of having their fertile and highly-productive land eventually overrun by expanding urban areas. At the present rate of urban development and the associated rise in land values, together with the changes adumbrated in the various

Photo: Dept. of Agricultu

Fig. 12. Lettuce being lifted and packed into Samoan and Tongan banana boxes on a European holding at Pukekohe

planning schemes, it appears that most of the traditional market-gardening areas within ten miles of the city market will be lost to agricultural production within the foreseeable future. However, the cultivation of tomatoes and cucumbers under glass can remain an economic proposition in built-up areas, for although a high capital investment is involved, a high return from a relatively small land area is possible.

However, in spite of the immediate and projected loss of market-garden land, there appears to be ample land within metropolitan Auckland, well away from urban development, suitable for intensive vegetable production. It is estimated that in the Franklin county alone, between Bombay and Waiuku, there are at least 15,000 acres of land which could produce vegetables all the year round. The physical setting of the area, the soil, the landforms and the climate are admirable for market gardening, and it is not insignificant that even now the area devoted to vegetable crops is increasing annually, mainly at the expense of pastoral farming. In the extreme north of the Franklin county, soils of the Karaka complex are poorly drained and are a deterrent to extensive vegetable production.

Mangere South, at present predominantly a town-milk supply area, has great potential. However, the main problem here is that the area is not reticulated for the supply of water, and any extensive development of vegetable production could prove extremely hazardous in dry weather as the light soils dry out very quickly. The Riverhead district appears ideal, but this area of flat-to-rolling land has the highest incidence of frost within metropolitan Auckland, and this may prevent the early or late cropping of vegetables which are frost-sensitive. Soil drainage is not always adequate in winter, even for dairying, and hence considerable artificial drainage would be necessary if winter crops were to be prevented from rotting.

Fig. 13. Market-garden land invaded at Pukekohe. A new school has been built on an Indian holding, now reduced in size

Unless a marked increase in the market-gardening acreage within metropolitan Auckland occurs within the next few years, the rapidly-increasing, mainly urban, population will become more and more dependent on external supplies of vegetables. Today greater quantities of vegetables than ever before are reaching Auckland from external sources—the estimated supply being approximately 35,000 tons annually, almost half of which are potatoes brought from the South Island by coastal shipping. At least three-fifths of the annual total weight of vegetables reaching Auckland by rail are potatoes, mainly from the Manawatu. Ohakune and Otaki are the principal sources of supply for mixed vegetables, especially in autumn and winter. Small quantities also come from the Pacific islands, Katikati, Levin, Hastings and Kaikohe. The extent to which present supplies could be increased is a matter for conjecture, for Ohakune, Otaki and the Manawatu also supply Wellington and other centres in the North Island. If local and external supplies of fresh vegetables become insufficient to satisfy the demand, the people of Auckland may have to turn to canned or frozen vegetables.

The present movement of market gardens away from the Auckland isthmus and its environs, although continuous, is piecemeal. Similarly, new vegetable-growing areas tend to be rather scattered, and their development is not planned. Yet despite the acreage lost to vegetable growing, and although the development of new areas has not kept pace with the increase of population, the city markets are seldom short of vegetables. Nevertheless the present, as well as the future, requirements of Auckland merit the increasing attention that is now being paid to the problems by administrators and town planners alike, for the market-garden industry is but one of the total complex of phenomena which make the Auckland metropolitan area distinctive in New Zealand.

THE SUMMIT AREA OF RUAPEHU*

B. E. O'SHEA

THE SUMMIT area of Ruapehu is bounded by an elliptical rim of low peaks and ridges which measures nearly two miles by half a mile and encircles two craters (*Fig.* 1). Although the rim of the basin has been considerably modified by erosion, it is well preserved in a few places, and its inner slopes show sections of lava flows which appear to radiate from a common source at a level higher than the present summit. These flows are well exposed on Te Heu Heu and Tukino Peaks, to the northeast of the summit, and on Paretetaitonga and Tahurangi to the west and south respectively. To the east the only remnant of the rim is at Cathedral Peaks. If it is presumed that the rim was once continuous, the missing portions have been destroyed, possibly by glacial action, but more probably by headward erosion by consequent streams on the outer slopes, for notches in the rim indicate a past erosion by radial streams flowing from a central and high centre. The surface configuration of the summit area indicates that recent volcanic activity has been confined to the vents of a 'north' and a 'south' crater. The 'north' crater is usually covered by *névé*, but during the late summers of 1954–1955 and 1955–1956 the remains of the crater rim were well exposed (*Fig.* 2).

The 'north' crater is bounded to the north and northeast by the Te Heu Heu and Tukino Ridges which represent the crater wall. This merges with a comparatively narrow and low rim of scoria and ash which turns eastward along the northeast side of the Whakapapa Glacier and eventually disappears beneath the Whangaehu Glacier. The highest point on this portion of the crater wall is the Dome (8,700 feet), which overlooks both the 'north' and 'south' craters (*Fig.* 2). The wall of the 'north' crater is represented to the east by a small remnant which also includes part of the old crater rim at Cathedral Peaks. To the north and south of Cathedral Peaks both wall and rim have been breached by the Mangatoetoenui and Whangaehu Glaciers respectively.

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*The author wishes to thank Professor R. H. Clark and Mr J. Bradley of the Victoria University of Wellington for valuable assistance.

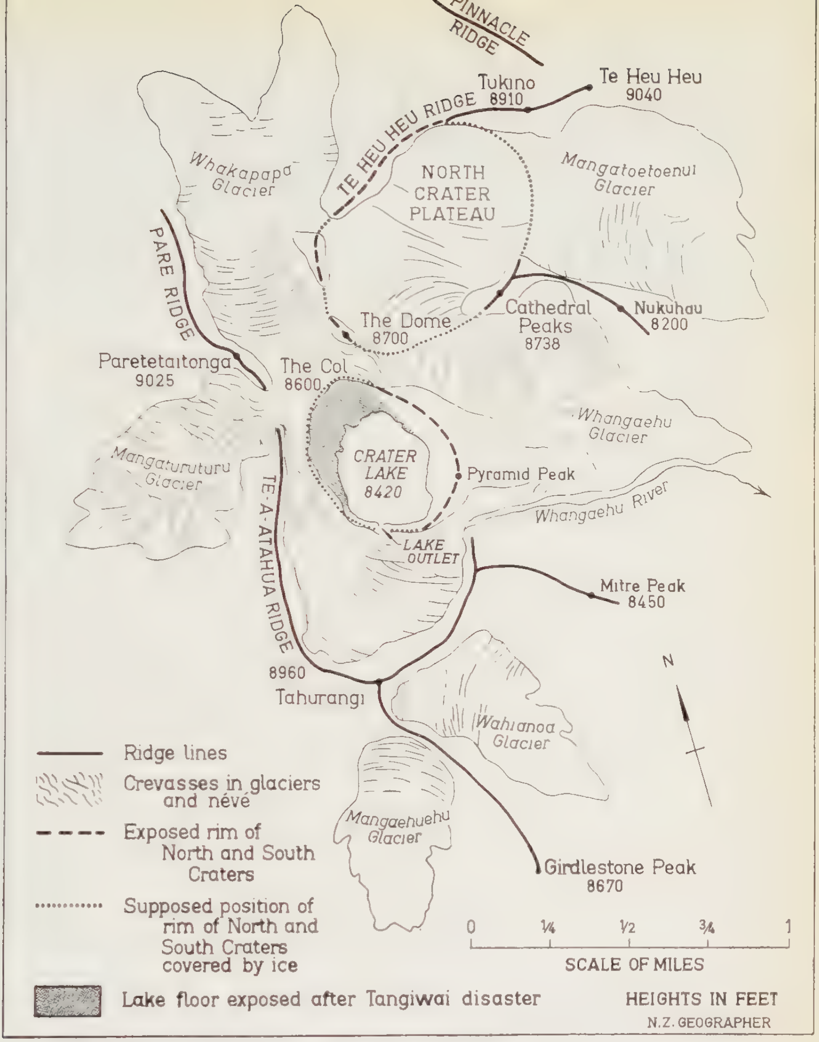
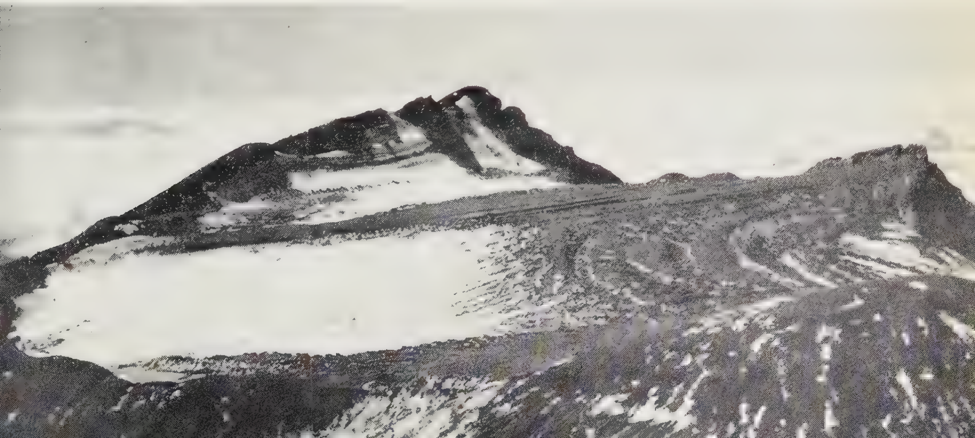


Fig. 1. The summit features of Ruapehu (map based on aerial photographs)

g. 2. From Paretetaitonga to the Te Heu Heu Ridge across the 'north' crater plateau, with athedral Peaks in the right distance and the Dome in the right foreground



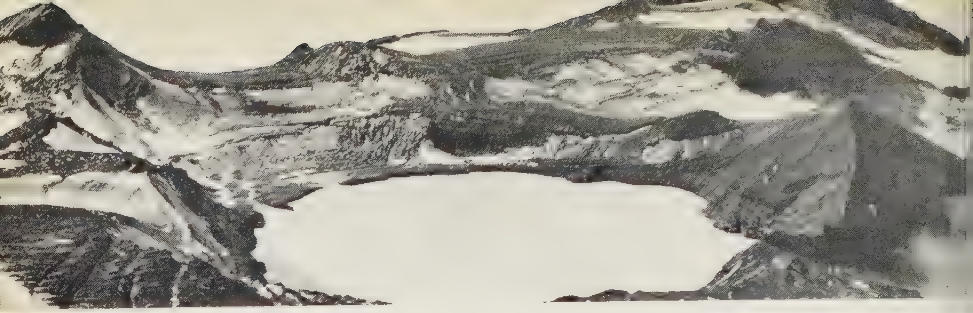


Fig. 3. From Tahurangi northwards across the lake in the vent of the 'south' crater to the Te Heu Heu Ridge in the far distance

The 'south' crater is still active and contains a small cone within which is situated a crater lake.[1] It is bounded on the west and south by Paretetaitonga, the Te-A-Atahua Ridge and Tahurangi, all built of the massive lavas of the south portion of the old outer rim. To the east of the crater, Pyramid Peak is the highest point on a composite rim of scoria, ash and minor flows which bounds the Whangaehu Glacier (*Fig.* 3).

Explosion or 'Explosion-Collapse'?

It may appear from the elliptical outline of the summit of Ruapehu that the volcano has resulted from the building up of two or more adjacent vents. However, it may be argued that, to the contrary, the present configuration of the summit is that of a typical caldera and results from the truncation of a once higher Ruapehu by caldera formation and erosion (*Fig.* 4).

Early theories of summit truncation postulated simple explosion on a grand scale. It was suggested by Speight[2] that the summit features of Ruapehu originated in this way. Williams[3] suggested a mechanism of explosion-collapse as a possible cause of summit truncation with the formation of a caldera. Grange and Hurst[4] may have had similar views when they suggested that 'ancient Ruapehu' had regained its former height and form by the addition of more recent lava flows after the top had been blown off or collapsed to the 7,000-foot level.

According to Williams[5] the early stages of caldera formation are represented by explosive periods accompanied by withdrawal of magma. It appears that these stages are represented, in the case of

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[1] B. E. O'Shea: 'Ruapehu and the Tangiwai Disaster', *N.Z. Journ. Sci. & Techn.*, Vol. 36B, 1954, pp. 174–189.

[2] R. Speight in L. Cockayne: 'Botanical Survey of the Tongariro National Park', *Append. Journ. House of Repres.* (C-11), 1908, pp. 7–13.

[3] H. Williams: 'Calderas and their Origin'. *Bull. Dept. of Geol. Sci., Univ. of Calif. Pubs.*, Vol. 25, No. 6, 1941, pp. 239–337.

[4] L. I. Grange and S. A. Hurst: 'Geology of the Tongariro Subdivision', *Annual Rep. Geol. Survey*, 1928–1929, pp. 5–8.

[5] Williams: *op. cit.*, p. 336.

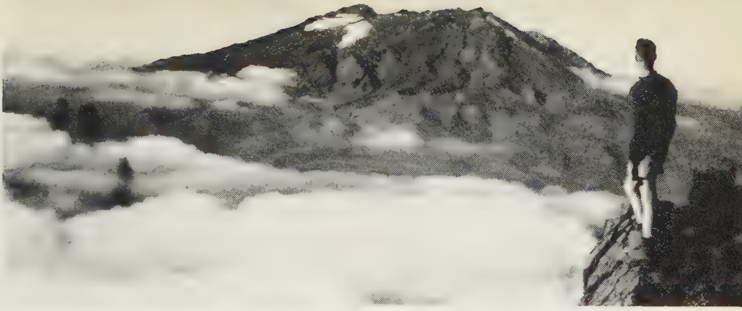

Fig. 4. Ruapehu from Ngauruhoe. Note the truncated summit of Ruapehu, the bifurcating Whakapapa Glacier and the radial valleys

Ruapehu, by deposition of at least part of the extensive Tongariro ash shower.[6] This was probably followed by collapse of the former higher summit as the magma withdrew below. During a period of quiescence after the collapse of the summit, erosion continued on the mountain flanks, and during this period, also, glaciers possibly redeveloped.

Later, two vents were opened out by renewed activity, and lava was erupted profusely, especially from the larger 'north' crater. The later lava tongues flowed into, and to a considerable extent filled, the radial valleys. Thus the lavas of 'ancient Ruapehu' were covered by newer eruptive materials. Grange and Hurst[7] observed these more recent flows which they described as being darker in colour than the earlier lighter-grey flows.

Recent work undertaken in the area of the Whakapapanui Gorge on the northern slopes of Ruapehu shows that these later flows lie unconformably on the earlier lava and agglomerate. As these lava flows overspread the snow and *névé*, melting gave rise to mud flows that formed the lahar mounds on the lower northern slopes of the mountain.[8] Crater lakes may have existed in either or both craters during this period and their waters may have been released during intermittent activity, also giving rise to lahars. From the 'south' crater minor eruptions have occurred to the present, which appears to mark a period of decadence.[9]

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[6] There appears to be only one extensive horizon of andesitic ash in the Tongariro Subdivision, and although the ash is referred to as the 'Tongariro shower' there is no reason to suppose that it came from Tongariro alone. It is possible that both Tongariro and Ruapehu have erupted large quantities of andesitic ash simultaneously, and it is difficult to determine the quantity emitted by either volcano. Microscopic study of the 'Tongariro shower' has revealed a mineral content similar to that of both the Ruapehu and Tongariro andesites: glass, plagioclase felspar, iron ore, hypersthene and augite. Near the mountains, especially to the west and south, the ash deposits rest on fluviatile conglomerates and agglomerates of possible lahar origin, which suggests a long period of quiescence and deep erosion before the Tongariro ash was deposited.

[7] Grange and Hurst: *op. cit.*, p. 6.

[8] L. I. Grange: 'Conical Hills on Egmont and Ruapehu', *N.Z. Journ. Sci. & Techn.*, Vol. 12, 1931, pp. 376–391.

[9] Williams: *op. cit.*, p. 241.

THE LOCATION OF OIL REFINERIES IN AUSTRALIA

M. B. DALE

THE OIL-REFINING industry in Australia has shown considerable expansion during recent years. From 1939 to 1948 capacity remained at 450,000 tons a year, but from 1948 to 1957 it increased by more than twenty-three times to a yearly total of 10,430,000. The major development took place after 1951 when considerable capital investments were made,[1] and when an important feature was the decentralisation of the industry—particularly to Western Australia and Victoria. When the refinery near Noarlunga, South Australia, comes on stream, the move away from the industrial centres of Sydney and Melbourne will be still more pronounced.

Obviously, the decisions which led generally to these developments and, in particular, to the siting of the new refineries, were based on many considerations. These are not always fully appreciated, and even oil-company executives hold widely differing views on the main factors involved. Markets and transport are prime elements, but spatial patterns of population, resources and means of production must also be considered—in addition to any long-term analyses of economic and social change. Even marketing traditions carry some weight.

Recent Growth and Changes in Consumption

Figures in Table I show that, just prior to the second World War, Australia consumed a little more than two million tons of oil products yearly. Of this tonnage, approximately two-thirds came from South-east Asia, mainly in the form of refined products.[2] Unfortunately there are no published figures to show the prewar consumption pattern by states. However, there is good reason to believe that most of the imported oil products went to the markets where they were ultimately sold. Thus, the statistics of oil imports, as shown in Table II, give a general idea of the magnitude of the demand for oil in the various parts of Australia.

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[1] Almost £120 million was expended in basic capital costs for four new oil refineries built after 1951. This figure exceeds that of £94 million invested in the steel industry over approximately the same period.

[2] The Netherlands East Indies and Borneo were the source of approximately 71 percent of the refined petroleum and some 46 percent of the crude oil importsi n 1938-1939. During this year the tonnage of crude oil was less than 25 percent of the total oil imports of approximately 450,000 tons.

During the year 1938-1939 more than twenty-four percent of all Australian oil imports were delivered to Western Australia and South Australia, which in that year contained only 15.3 percent of the population of Australia and a still smaller proportion of the country's industrial capacity. There are two reasons for the heavy demand for oil in these two markets. First, Fremantle, a terminal port on the sea route to major oversea markets and the Middle East oilfields, is traditionally the largest bunkering port for vessels from overseas. Second, in these states which are most distant from Australia's major black-coal deposits, an interest in oil as an industrial fuel was developed at an early stage.

TABLE I

ANNUAL CONSUMPTION OF OIL IN AUSTRALIA

1939 . . .	2,100,000 tons	1954 . . .	6,157,000 tons
1949 . . .	3,772,000 tons	1957 . . .	7,792,000 tons

TABLE II

DISTRIBUTION OF OIL IMPORTS: 1938-1939

State	Thousands of Gallons	Percent of Total
New South Wales	196,523	32.75
Victoria	178,107	29.68
Queensland	68,923	11.49
South Australia	60,212	10.03
Western Australia	84,461	14.08
Tasmania	11,211	1.87
Northern Territory	602	.10
Total for Australia	600,039	100.00

It is noteworthy that the proportion of oil used in the various states has changed remarkably little since 1938-1939. As is shown in Table III, the proportional consumption of New South Wales and of South Australia has remained very much the same, whilst that of Queensland

and of Western Australia has receded. On the other hand the proportion taken by Victoria and Tasmania has increased, and the Northern Territory, which imported only negligible quantities in prewar days, now accounts for one percent of the market.

More significant is the change in the pattern of demand in terms of quality (Table IV). Before the war, fifty-six percent of the oil was sold as motor spirit, a highly refined and relatively highly priced product. The proportion of fuel oils was only twenty-nine percent. This relationship changed in the postwar period. In 1957 the quantity of fuel oils virtually equalled the quantity of motor spirits. Thus the demand for the cheaper bulk products had increased considerably. Another change in the pattern of consumption has been the increased demand for the more specialised 'other products'. With greater industrialisation, the proportion of these has increased from fifteen to eighteen percent. With further advances in aviation, in the chemical field, and in the engineering industries, the proportion and the diversity of these 'other products' is likely to increase further.

TABLE III

Estimated Pattern of Oil Consumption*

State	1938-1939	1957
New South Wales	32.75	33
Victoria	29.68	31
Queensland	11.49	10
South Australia	10.03	10
Western Australia	14.08	12
Tasmania	1.87	3
Northern Territory	0.1	1

*By percentages.

Factors Influencing Refinery Location

Before the second World War Australia had two oil-refining plants, both relatively small units. One was established by the Commonwealth Oil Refineries (now BP Australia Ltd) at Laverton, an outer suburb of Melbourne. Another unit was erected at Clyde in Sydney by the Fell family, but this was sold later to the Shell Company of

Australia. Three main factors influenced the location of these early plants: first, the access from the sea was good and of sufficient depth to accommodate the tankers used in prewar days which carried between 12,500 and 16,500 deadweight tons; second, the large markets of Melbourne and Sydney could easily absorb the whole production of these refineries; and third, the establishment of refineries in the largest markets brought strategic advantages and industrial prestige to the country as a whole. The latter could well have been the most important motive of the Commonwealth Government when passing the Oil Agreement Act of 1920, thus taking the first step toward establishing an oil-refining industry.

TABLE IV

ESTIMATED CONSUMPTION OF PETROLEUM PRODUCTS

Products	1939 Thousands of Tons	1939 Percent of Total	1957 Thousands of Tons	1957 Percent of Total
Motor spirit	1,187	56	3,198	41
Fuel oil (including bunkers)	629	29	3,170	41
Other products	317	15	1,424	18
Total for Australia	2,133	100	7,792	100

However, less than twenty-five percent of the prewar demand for petroleum in Australia was refined locally. Before 1939 there was a much smaller demand, both relative and absolute, for fuel oils than there is today. Since this pattern was world-wide, an oil company could save a great deal in transportation costs if it left its 'residual products' behind. The prewar tendency was, therefore, to refine near the source of crude oil and then ship the finished products to the nearest markets. The unsaleable 'bulk oils' were dumped. In Persia, for instance, large quantities of fuel oils were pumped back into the ground. With the postwar change in the patterns of demand, however, the cost differential between transporting refined oils with a very large proportion of bulky products, or bringing in crude oils, has narrowed considerably.

Refining techniques have improved too. Following a series of

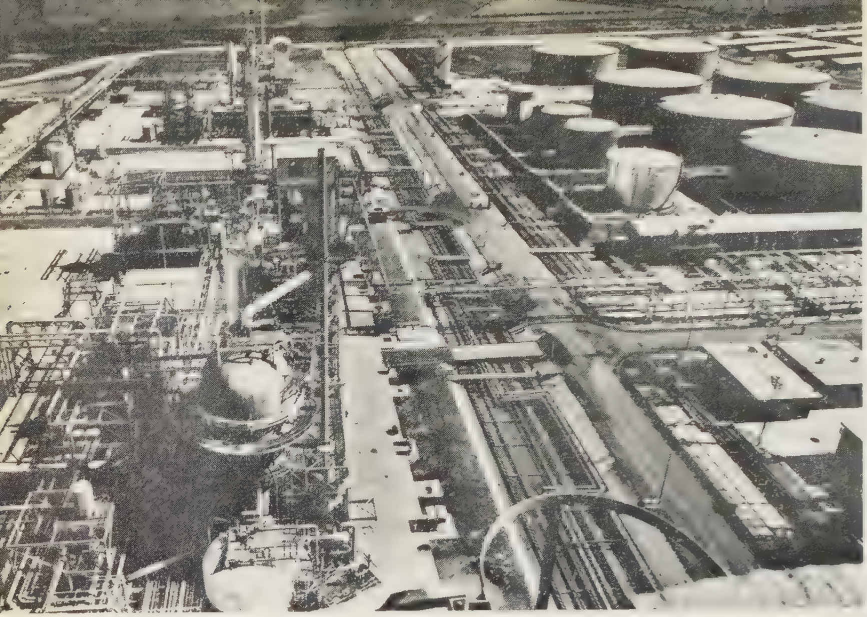

Photo: Shell Compan of Australia

Fig. 1. The need for space—part of the Geelong refinery of the Shell Company with the company's housing estate in the distance

technical break-throughs, by the end of the 1940's, the industry had attained a high degree of flexibility, and medium-sized refining units are now able to produce a great number of products to satisfy the increasingly diversified demands of their local markets. In addition, the introduction of large tankers has made it economically undesirable, and frequently impossible, to transport relatively small cargoes of different products to several ports. The depth of water at loading and receiving terminals has now become a major consideration, and it is now desirable to erect the refineries on the receiving end, alongside deep water and with good distribution facilities to the traditional markets.

Another not insignificant general consideration, when building an oil refinery, is political stability. It does not need stressing that in this respect Australia has a real advantage over the producing countries of the Middle East and Southeast Asia. It is not an accident that, following the Persian crisis of 1952, all major oil companies have speeded up plans to install new oil-refining plants in the commonwealth. As is shown in Table V, new refineries built in Australia since the last war are considerably larger than the prewar units, and locational factors have been correspondingly more complex. The proximity to markets is still important, but larger and heavier equipment and greater tankers require a special environment.

Obviously, the bigger the refinery, the greater is the need for more space and for more cooling water. Space requirements demand deep sea-channels for incoming tankers, sufficient land for extensive storage facilities, a generous provision for cargo-handling appliances, wide road approaches, and housing facilities for the personnel. Hence, when assessing the site of a new refinery, the following characteristics may have to be considered: first, availability of sufficient flat land with good foundations suitable for large-scale construction, including that of heavy buildings and large storage tanks; second, access to plenty of clean water, free of sediment and organic impurities; third, direct access to deep water, or location adjoining a seabed which can be economically dredged and which does not silt easily, the site being reasonably well sheltered from winds so that tankers can discharge their cargo, or can load, all the year round. The siting of wharves and jetties in such a harbour is of paramount importance.

TABLE V

AUSTRALIAN OIL REFINERIES

Location	Date on Stream	Present Capacity*	Distance in Miles to Nearest Capital
Clyde, New South Wales	1925	0.60	13
Matraville, N.S.W.	Oct. 1948	0.83	10
Altona, Victoria	Jan. 1949	1.75	10
Geelong, Victoria	Mar. 1954	2.4	43
Kwinana, Western Australia	Feb. 1955	3.0	24
Whinstanes, Queensland	Sept. 1955	0.10	7
Kurnell, New South Wales	Feb. 1956	1.75	22

*In millions of tons.

Other features to be assessed are: fourth, in order to ensure economical distribution, location in the vicinity of a focal point for both transport and communications serving the refinery's marketing area. Under Australian conditions, this means both adequate rail connections to serve the distant hinterland, and wide road approaches to serve nearby markets.[3] Since, in Australia, there is a centralisation of land routes to the capital cities, none of the refineries is more than forty-three miles from the nearest state capital (Table V). Fifth, it is desirable that a refinery should be well placed for the local disposal of most of its non-liquid residuals and by-products since these cannot carry high distribution costs; and sixth, if there is a good local market for by-products, but a high proportion of the refined petroleum has to be reshipped, it is an advantage to have the plant at a sea terminal located between its source of supply and the refinery's major markets.

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[3] Where roads are adequate, road tankers could be, in most cases, the cheapest form of bulk liquid transportation for distances not exceeding 200-250 miles. However, in Australia each state has legislation, or special taxes, which compel oil companies to use railways beyond a certain distance.

A detailed analysis of all these factors is not possible here. However, even a generalised list, as that above, reveals a strong interplay of the local setting, which is relatively stable, with such other elements as the proposed site's patterns of transportation, communications and marketing, all of which are continually changing. The most quickly changing, and therefore the least accurately determinable of these elements, is the marketing pattern. It is therefore not surprising to find that the evaluation of markets by individual business firms is frequently influenced by the residual momentum of their past marketing activities. Hence, the locations of new industrial plants are sometimes not fully explicable except in terms of the producing firm's marketing traditions and the seat of managements.

The Postwar Refineries

Before the second World War more than seventy percent of the oil business of Australia was shared between the two oldest-established companies, Standard-Vacuum and Shell. These two firms entered the Australian petroleum market around the turn of the century and both established their marketing headquarters in Melbourne. The selection of the Victorian capital, which was also the commonwealth capital at the time, may have been due to a variety of reasons: financial, political and geographical. All that can be said in retrospect is that it established a marketing tradition for the companies concerned, and that geographically it was well justified. In the early 1900's, Melbourne was the most effective hub of inland transport in Australia. All populated parts of Victoria and most settled areas in South Australia had direct railway connections with this city, whilst the southern and western areas of New South Wales could be conveniently supplied from Albury, a major terminus of the Victorian railways at the break of gauge with the railways of New South Wales.

This somewhat generalised picture of the marketing and distribution

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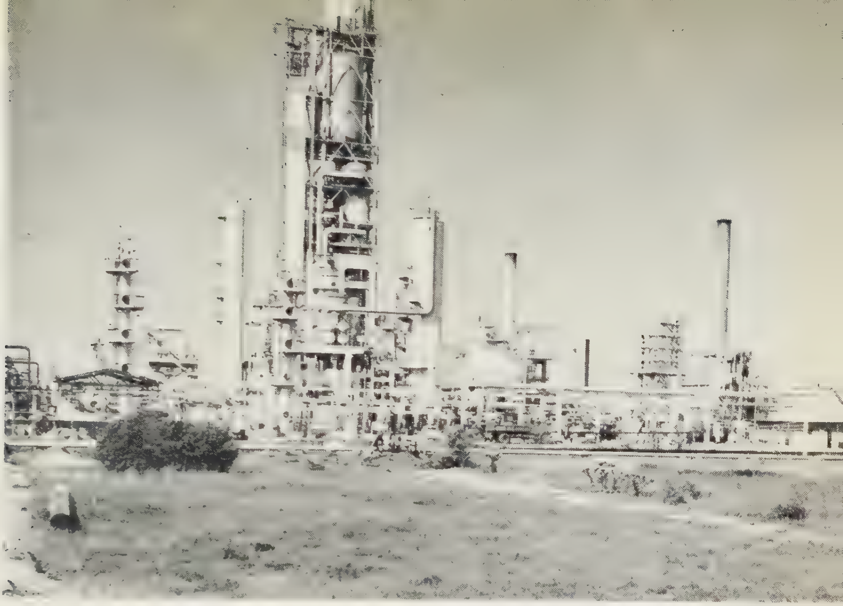
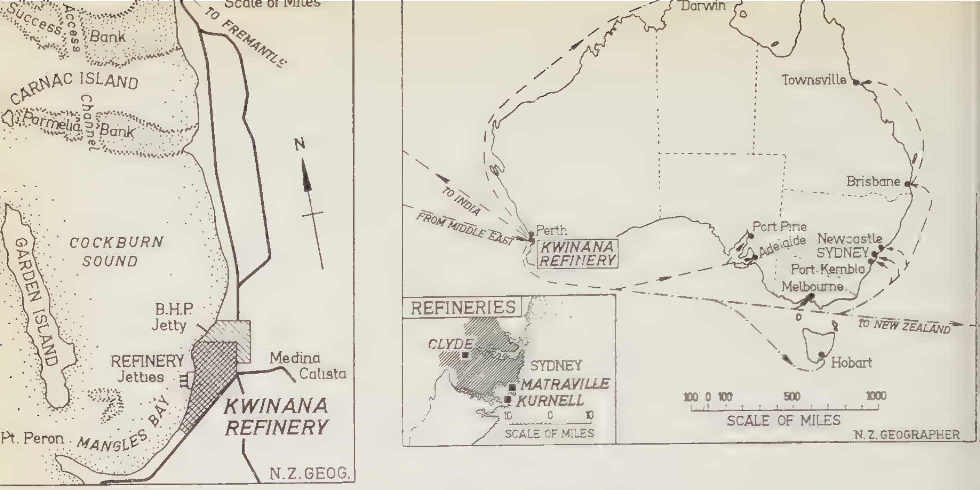


Fig. 2. The need for capital and heavy equipment—the cracking unit of the Altona refinery of the Standard-Vacuum Company near Melbourne

pattern and organisation may go some way to explain why the first refineries built in the postwar period by Shell and Standard-Vacuum were located in the Melbourne region, despite the fact that shipping conditions through the heads of Port Phillip Bay may handicap the use of really large supertankers.

A contrast between the supply and transport pattern of the two Victorian refineries is interesting. The Standard-Vacuum refinery at Altona is right on the fringe of the Melbourne metropolitan area. It has a good shipping channel thirty-six feet deep, but its connecting road arteries frequently become congested. The Shell refinery at Geelong is some forty-three miles from the capital but has a direct pipeline to Melbourne. The shipping channel, seventeen and a half miles long, which leads to the refinery jetties has a relatively hard bottom which is costly to dredge. On the other hand, Geelong provides less congested road and rail facilities than Melbourne to the western parts of Victoria.

The third largest marketing company, BP Australia Ltd, is a subsidiary of the British Petroleum Company in the United Kingdom. As it is well known, this latter company was the first oil producer in the Middle East and was the original supplier to the British Admiralty and most large British shipping lines. As a result, the British Petroleum



Figs. 3 and 4. The site of the Kwinana refinery and the pattern of distribution of its products. *Inset*: Refineries in New South Wales, adjacent to Sydney

group became the major supplier of bunker oils in the larger Australian ports and was the first and most important importer of crude oil and refined products from the Middle East to Australia.

The fact that Fremantle is the nearest major Australian sea terminal to the British Petroleum Company's prolific sources of supply in the Persian Gulf may at least partly explain why the largest oil refinery in Australia is located at Kwinana. The plant there adjoins a natural deep-water anchorage thirty-two square miles in area within fifteen miles of Fremantle. Another factor which influenced the choice of this particular site was that the government of Western Australia was willing to provide a new railway link, electricity, a water supply, new road approaches and housing in the modern township of Medina. In addition, the government undertook to dredge a channel thirty-eight feet deep and 500 feet wide, thus opening a well-sheltered harbour to supertankers (*Fig.* 3). Another consideration was that oil tankers were exempted from the payment of tonnage rates, pilotage fees and most wharfage charges.[4]

A critical factor is that Kwinana is favourably situated for the reshipment of its products to other ports by sea—an important consideration for a major supplier of bunker oils to all major Australian ports (*Fig.* 4). Yet another deciding factor could have been the size of the local market for heavy oils. As shown in Figure 7, one fifth of all the fuel oils in Australia are sold in the hinterland of Kwinana.

Of the New South Wales refineries listed in Table V, the Matraville plant of Bitumen and Oil Refineries Ltd (BORAL) was the first oil

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[4] *Fremantle Harbour Trust Report*, 1957.

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BP Australia
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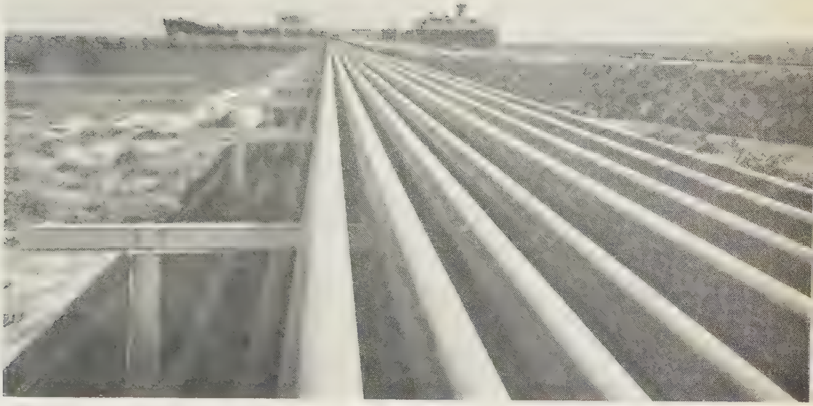


Fig. 5. The need for deep water—the oil jetty at the Kwinana refinery, West Australia

refinery built in Australia after the second World War. Choice of site here may well have been influenced by three factors: first, the initiative to establish a new refinery came from local interests in Sydney; second, the largest shareholder in the new refinery, Caltex Oil Co., had its Australian headquarters in Sydney and its strongest markets in New South Wales and Queensland; third, New South Wales is the largest market for oil products in Australia. In addition, since the oil wharves at Brisbane are not accessible to tankers carrying more than 11,500 tons of oil, southeast Queensland may be considered to lie within the hinterland of any major refinery operating at Sydney.

The largest New South Wales oil-refining plant, that on the Kurnell Peninsula, is operated, through the Australian Oil Refining Company Ltd, by the three well-known oil companies—Caltex, Ampol and Sleigh. Of these three, the two major partners, Caltex and Ampol, have their head offices in Sydney, and all three are believed to have a somewhat stronger market position in New South Wales than in Victoria.

Queensland has only a small plant which produces mainly bitumen and heavy fuels for the local market. Refinery development in this state was handicapped by two major controls. First, as shown in Table VI, the harbour at Brisbane is not accessible to fully-loaded modern tankers; second, the present trend is to increase imports of crude oil from Middle East sources (Table VII). If oil in commercial quantities were discovered in Queensland or New Guinea, Brisbane might become a terminal port for the refining and reshipment of northern oils, but so long as present supply trends continue, the southern capitals appear to have the advantage of being situated along the main transport route of oil from overseas.

The decision of Standard-Vacuum to erect a new refinery in South Australia shows a somewhat similar combination of physical, supply, and marketing considerations to those which led to the building of a major refinery in Western Australia. At Noarlunga are large tracts of lowland within twenty miles of Adelaide. Here, the South Australian government authorities undertook to provide housing, services and communications. It has been announced that Halletts Cove will be opened up to receive tankers of up to 60,000 tons deadweight. A critical factor appears to be that the new refinery site is favourably located for the receipt of Middle East crude oil by sea. As shown in Figure 6, Noarlunga is in the region where the maximum belt of motor spirit consumption adjoins the shortest route to the Persian Gulf. Hence very little backloading will be necessary when reshipping that portion of the refinery's production which is not sold on the local market.

TABLE VI

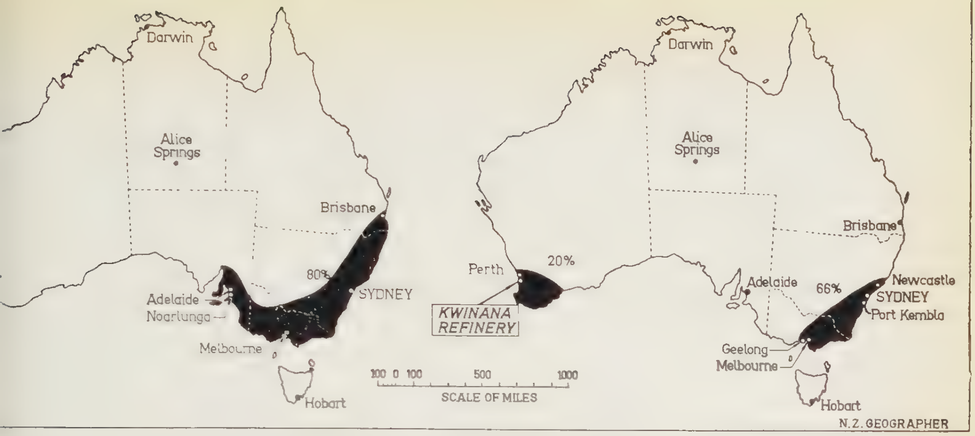
DEPTH OF WATER AT OIL-REFINERY WHARVES

Refinery	Depth of Water in Feet	Estimated Max. Size of Tankers in Deadweight Tons
Kwinana: Jetty	44.25–45.25	32,000
Channel	38.25*	
Williamstown Oil Berth, Altona	36	35,000
Geelong Refinery Pier	32	19,000**
Kurnell (AOR)	35	32,000
Matraville (BORAL)	36	35,000
Brisbane Oil Wharf	28.5	11,500
Standard-Vacuum refinery planned for South Australia	n.a.	60,000

*Further dredging planned.

**28,000 tons deadweight when present dredging programme completed.

A great part of the bulky by-products can be marketed on the spot. Because of its distance from both the New South Wales and the local



Figs. 6 and 7. The motor-spirit market (left) and the fuel-oil market (right) in Australia. Note the situations of Noarlunga and Kwinana respectively

coalfields, Adelaide is a market where residual oils and refinery gases have a good chance of being cheaper than most grades of coal. In addition, it is hoped that the consumption of petroleum products in South Australia will increase more than in other parts of the commonwealth, particularly when the new steelworks and car plants commence production.

TABLE VII

SUPPLY PATTERN OF CRUDE-OIL IMPORTS*

Source	1953–1954	1956–1957
Indonesia and Borneo	53.39	35.23
Middle East	36.15	61.46
Others	10.46	3.31

*In percentages of total oil imports.

This optimism is factually supported by past trends, for the consumption of oil products between 1951 and 1956 increased more steeply in South Australia than in most other states (Table VIII). The setback in 1957 may be only temporary.

CONCLUSIONS AND OUTLOOK

Thus many combinations of factors control the pattern of location in the Australian oil-refining industry. From the geographer's point of view, some of these factors, such as shipping routes from supplying areas, and political conditions at the source of oil and in the consuming country, have more or less general application. Other factors, such as market potentials, marketing traditions and the local setting, determine the siting of individual plants.

In Australia, where there are long distances between clusters of coastal settlements, the cost of distribution becomes a vital factor in the price of oil. Hence, there was initially a tendency to build the plants virtually in the middle of the largest markets surrounding Melbourne and Sydney, but more recently there has been a shift westwards to the water transfer points of Kwinana and Noarlunga. The first of these two refineries is an obvious transhipment port between the Middle East and the major fuel-oil consumption centres of Australia, whilst the second may be considered as a gateway to the belt of maximum consumption in the country's motor-spirit market (*Fig.* 6).

TABLE VIII

INDICES OF TRENDS IN OIL CONSUMPTION

Year	Victoria	N.S.W.	Queensland	S. Aust.	W. Aust.	Tasmania
1950	100	100	100	100	100	100
1951	135	116	119	122	122	113
1952	132	114	119	119	118	113
1953	137	118	125	122	117	113
1954	147	129	142	133	126	137
1955	172	145	156	159	156	150
1956	196	167	165	187	174	169
1957	203	190	179	162	166	188

Since, by the early 1960's refineries will be located in the vicinity of all state capitals along the west-east axis of the major oil supply route, the question arises whether the decentralisation of the industry away from Melbourne and Sydney has reached its economic limits. Today, virtually all the major marketing areas in the commonwealth are reasonably well served with refineries. The main potential exporting areas are Western Australia and South Australia, whilst the northeastern markets north of the border of New South Wales and Queensland are the main importing regions. Therefore, it would not be surprising if future construction were centred again nearer the major eastern markets unless commercial quantities of flow-oil are discovered in New Guinea or Australia. If this happens a more complex pattern could evolve, with new refining capacity shifting to the vicinity of the oilwells.

AUCKLAND BY GASLIGHT: AN URBAN GEOGRAPHY OF 1896

R. W. ARMSTRONG

TOWNS are like the people who live in them. Their character is moulded by the work, attitudes and spirit of the population. Auckland in the 'nineties is as quiet and conservative, as industrious and Victorian as the individuals living in it. The depression in the early years of the decade brought widespread unemployment and hardship to most of the townsfolk, and many were attracted to better conditions in Canterbury and Otago. But the situation is improving. Exports of gold from Thames and kauri gum from Northland are producing more than three-quarters of a million pounds annually, whilst timber milled in the province each year now exceeds eighty million sawn feet. Improved road and rail services now supplement the extensive water communications which link not only the early-established goldfields, gumfields and sawmills to the port and commercial centre of Auckland, but also the new grain, beef and dairy farms of the Waikato, Hauraki and Bay of Plenty lowlands. A distinct focus of all the commercial, industrial, educational and social activities in its province, Auckland is the one large, and now rapidly-growing, centre. The 58,000 people who live in the city and suburbs comprise more than one third of the provincial population and make Auckland the largest town in the Colony of New Zealand.

Of this total, 43,000, or seventy percent, reside in the compact city proper, an area four miles long and one and a half miles deep on the southern shore of the Waitemata Harbour. Enclosing it are the administrative boundaries of the city of Auckland, the boroughs of Parnell, Newmarket and Newton, and the ridings of Grafton, Parnell and Newton of Eden county (*Fig.* 1).

THE PROSPECT FROM MOUNT EDEN

From the top of Mount Eden the extent of the city is plainly visible. In its valley lies Queen Street, the brick and stone heart of the city, sprawling for three-quarters of a mile back from the waterfront, and across to Freemans Bay in the west and to Mechanics Bay in the east. Smaller, less important shopping centres in the residential suburbs of

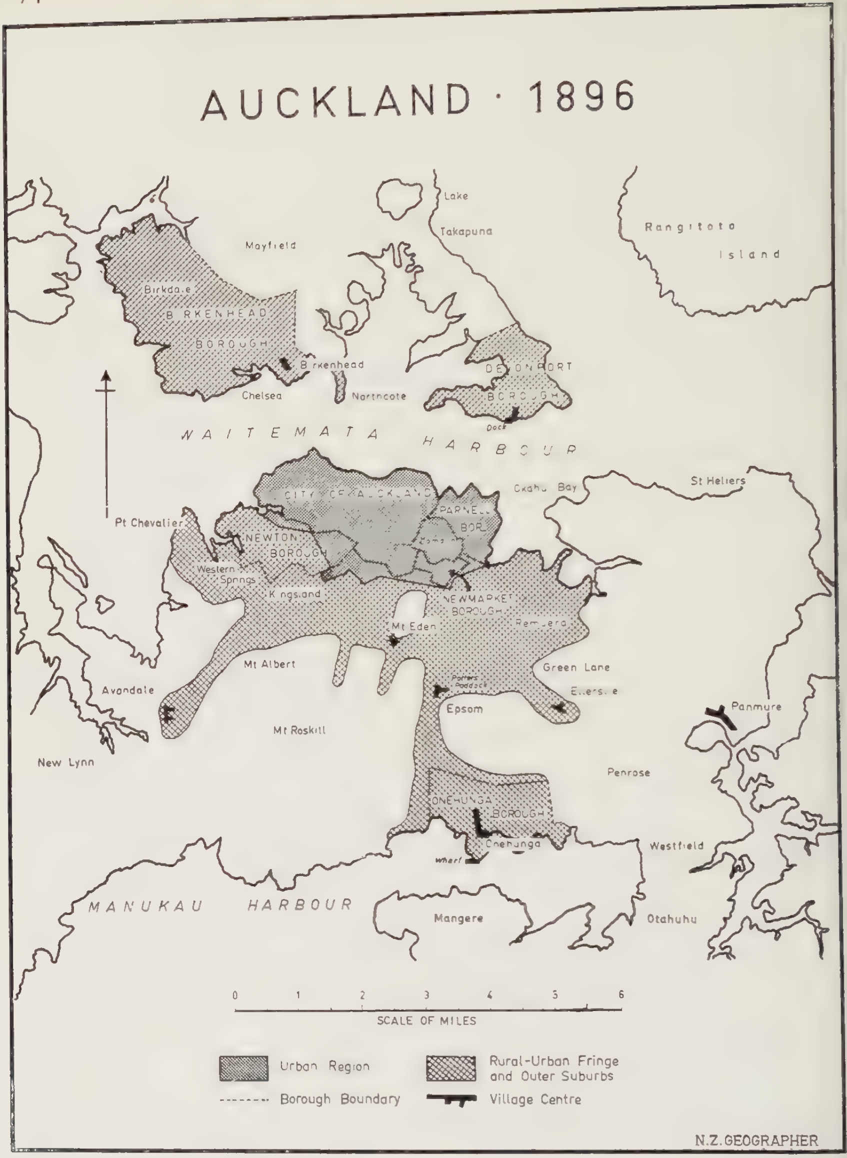


Fig. 1. Auckland in 1896: the city and outer suburbs

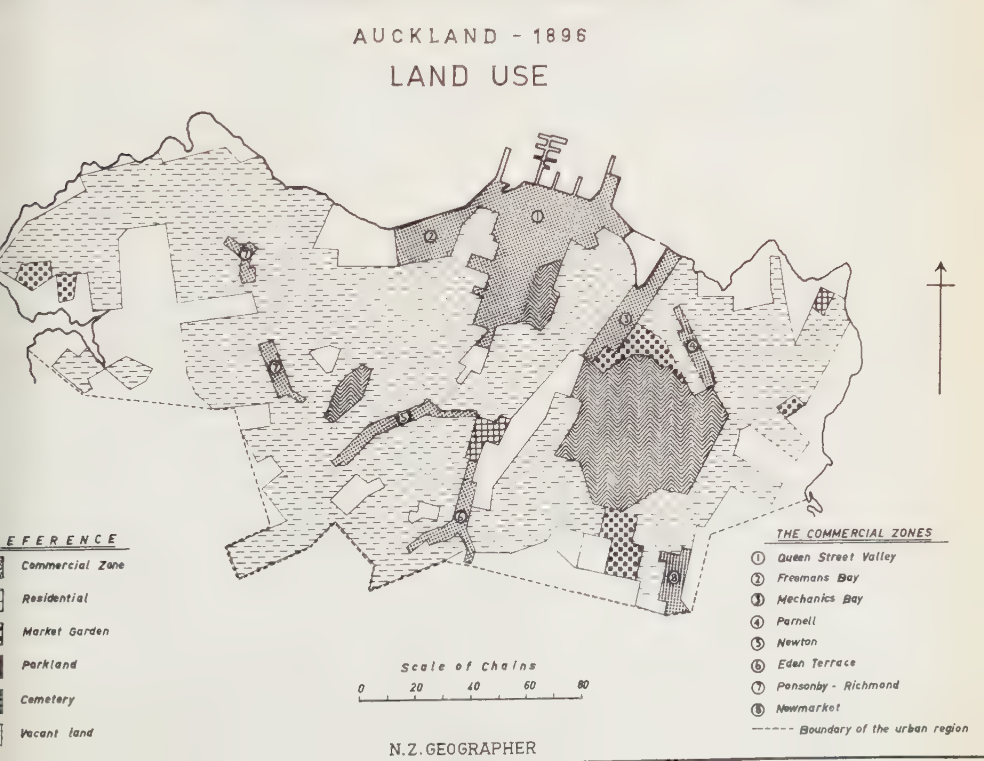
Parnell, Newmarket, Eden Terrace, Newton and Ponsonby-Richmond, extend in a broken crescent to the south of the central core—little foci of activity amid the rather dull residences. Relieving the monotony of the dull rows of houses and buildings, however, are avenues of plane-trees and enclaves of bush in Grafton and Parnell gullies, whilst the greens of Western and Albert Parks and the Domain do much to lighten the drabness of the landscape (*Fig.* 2).

The closely-settled city suburbs end almost abruptly and are replaced by scattered small farms and lines of working-class homes along the roads leading from the city. This rural-urban area is one of development and transformation as farms give way to the gradual extension of residences. The outlying villages of Avondale, Mount Eden, Epsom, and Ellerslie lie to the south two to three miles away at the extremities of these ribbons of settlement along the main roads. Along the Auckland–Onehunga road settlement is continuous, linking the borough of Onehunga, the port on the Manukau Harbour, with the city on the Waitemata Harbour (*Fig.* 3). To the north of Auckland, the residential boroughs of Devonport and Birkenhead complete the extent of urban development.

FUNCTIONS OF AUCKLAND

Auckland is pre-eminently a commercial town and secondly a manufacturing centre. After this comes its administrative function, and finally the town is the provincial focus of professional, educational and social activities. The magnitude and importance of all these create the essential role of the city as the leading centre in the province, and it provides, in addition, services to the colony as a whole and to the islands of the South Pacific.

Fig. 2. Land use in the city of Auckland in 1896



Auckland's most important single function is as a port. All commercial activity is centred around the reception and distribution of goods imported, exported and trans-shipped from the wharves, and the port ranks as the leading one in the colony in terms of tonnage and the number of ships that arrive and depart. Gum, gold and timber figure most prominently among a variety of exports, and it is in the sorting, packing and milling of these commodities and the supervision of their despatch that most of the merchants of the city are engaged. Imports are predominantly general merchandise, steel goods, and sawmilling and mining machinery. These reflect the *entrepôt* character of the port, for almost half of the imports are repacked and trans-shipped elsewhere. Nearly sixty percent by value of both imports and exports are with Britain. Australia, the islands of the South Pacific, and the United States provide additional opportunity for trade, but all three are far less significant than Britain.

Inadequate Port Facilities

Port facilities are inadequate to handle the amount of shipping and cargo that now enters the Waitemata Harbour each year. Only the Queen Street wharf can accommodate the large oversea sailing barques and full-rigged iron paddle steamers at the two northern berths of its outer tee. Small steam and sailing scows, trading to provincial ports such as Thames and Coromandel, Whangarei and the Bay of Islands, line the inner tees and four smaller wharves. Ships are often aground at low water and continual dredging is required to overcome silting from city sewers directed into the wharf area. Cargo is loaded and unloaded by the ships' own winches, and only a few small wharfside cranes are available to load waggons and drays. Owing to the lack of shed space, most cargo is simply dumped on the wharf to await collection. There are no rail tracks along the flimsy wooden wharves, and all goods are loaded by lumpers on to horse-drawn drays for cartage to the railway goods depot a quarter of a mile away or to warehouses in the city (*Fig.* 4).

Activity on the waterfront reaches its peak with the arrival of a mail steamer. There are rows of cabs with their owners noisily vying for custom, a motley collection of lumpers, passengers, officials and loafers, groups of Maoris selling water melons, peaches and smoked fish, and numerous waggons and drays clattering along the loose decking amidst piles of merchandise.

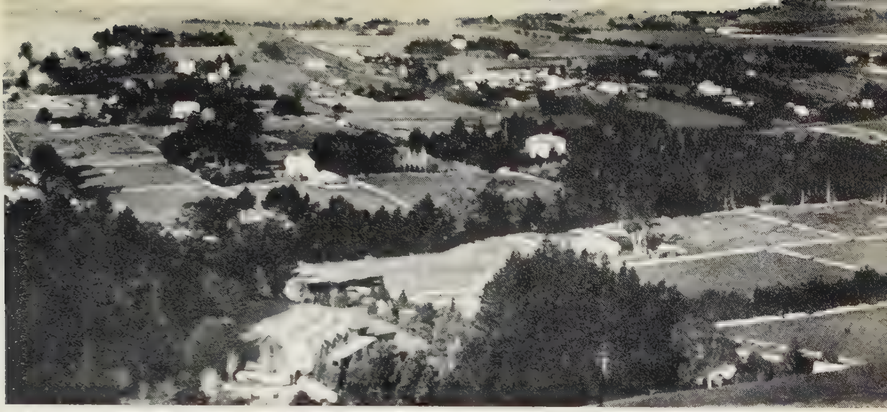


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Fig. 3. Epsom from Mount Eden, One Tree Hill in the distance. Stone walls enclose the fields of dairy farms, and pines and gum trees surround the two-storeyed farmsteads. The racecourse and showground on Potters Paddock lie at the foot of One Tree Hill

Photo: Auckland
War Memorial
Museum Library

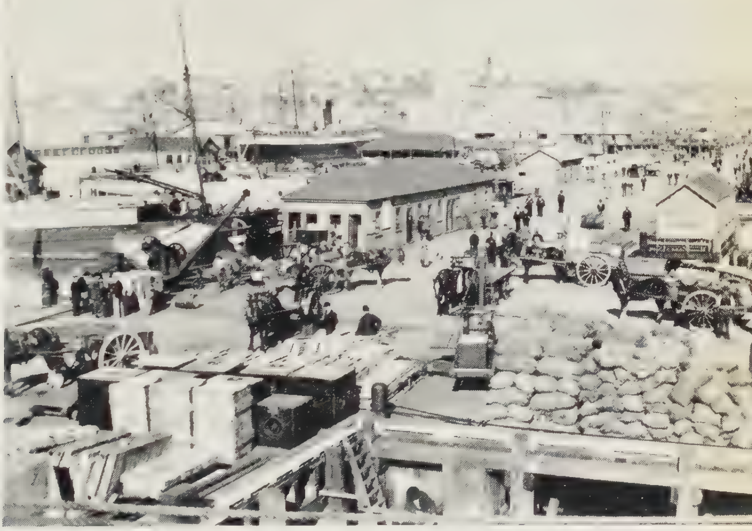

Fig. 4. Queen Street wharf with sacks of vegetables, crates of corrugated iron and canisters of pottery stacked in the open. The San Francisco mail steamer, the *Alameda*, is berthed at a newly-dredged inner wharf

Fig. 5. Mechanics Bay and Parnell from Constitution Hill. At the corner of Stanley Street is an hotel, with the Maori hostelry nearby. The residential area of Parnell covers the ridge and beyond, whilst the railway to Newmarket crosses Alpha Street at the foot of the hill

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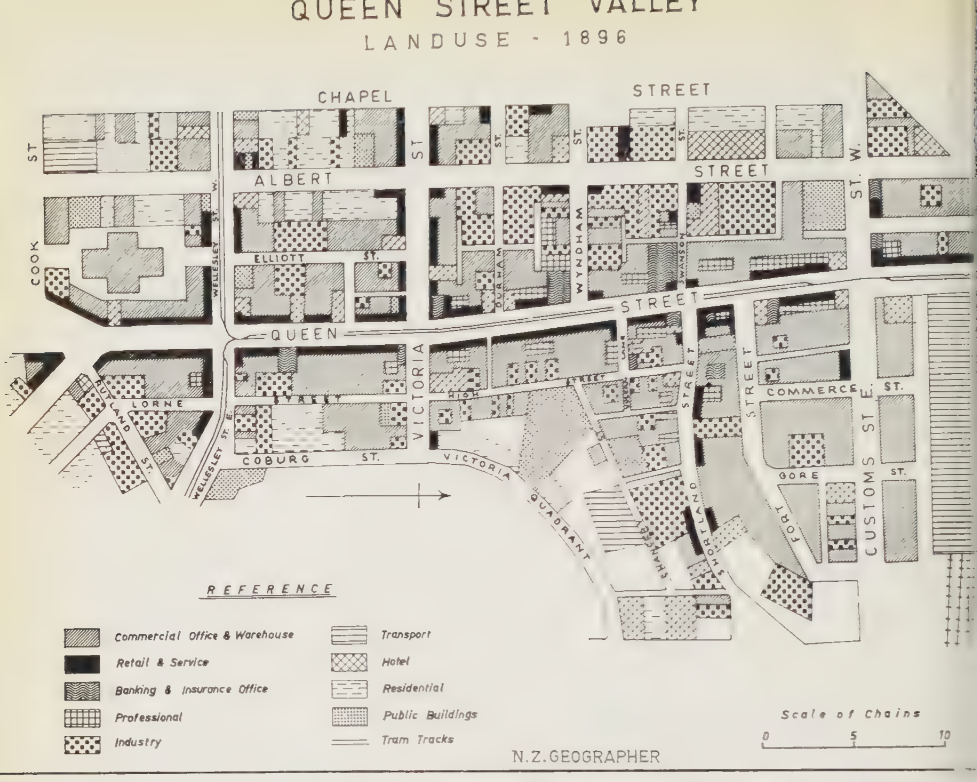


Fig. 6. Land use in the commercial core of Auckland in 1896

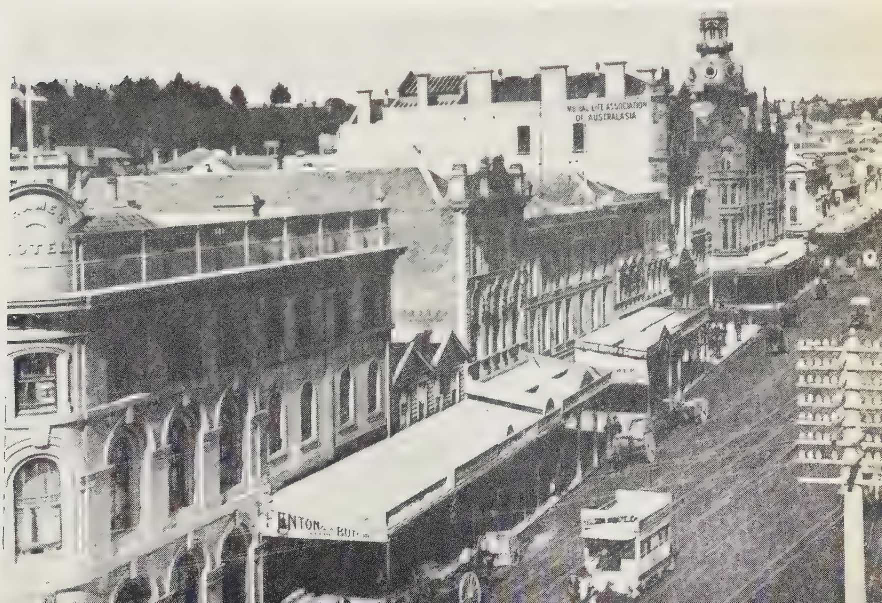
However, the working of the port is only one part of the town's activity. The greatest number of people find their livelihood in the warehouses, offices, retail shops and industries of the Queen Street 'valley'. This is the city proper, the heart of all urban activity on the isthmus, and the centre from which all major service and administrative functions radiate. Queen Street itself, running the length of the valley, has an unrivalled claim to its title of 'main street'. In the three-quarter-mile lower section of the street, the city's largest and most modern buildings are an expression of highly-developed land use characterised by variation and intensity (*Fig.* 6). The complex pattern of adjoining side streets with their haphazard intermixture of building styles and classes shows less variety of land use. Federal Street on the west and Albert Park–Princes Street on the east mark the extent of the urban core. In its valley situation the urban profile appears lowlying in relation to the neighbouring ridges—a jumble of iron and slate roofs, ventilators and chimneys, broken only by the prominence of tall smokestacks and an occasional church spire. The most imposing collection of buildings in the city—over three storeys in height—is located in the block bounded by Customs, Victoria, High and Albert

Streets. The ornate facades with their intricately-adorned balustrades, gargoyles, architraves, columns and finials represent an unrestrained mixture of architectural styles in keeping with the fashion of the period. But this impressive profile is quickly lost further up the valley. Two-storey buildings with only an occasional structure of three or four storeys is the rule. In this urban section of Queen Street all buildings are of brick with concrete ornamental facades except for one remaining two-storey wooden shop in lower Queen Street that is dwarfed by its three-storey brick neighbours (*Fig.* 7). These buildings back on to dingy, narrow access lanes where bare windowless walls are a contrast to their frontal grandeur.

Albert, Federal and High Streets, running parallel to the main street, are occupied by small buildings of two or three storeys and of varying size and construction, in which are small factories, warehouses and occasional residences. Many of these wooden buildings standing alongside more modern brick structures were formerly opulent residences, now converted in their decadent state to commercial use. The Shortland–Fort Street area contains some large two-and-three-storey brick warehouse and factory agglomerations, interspersed with low wooden shops and offices. This irregular profile is accentuated by a number of tall chimney stacks marking the site of industry. The comparative recency of the reclaimed foreshore is reflected in its low skyline and lack of development. To the east, the sprawling railway yards and

Fig. 7. Lower Queen Street. Multistorey buildings with ornate facades crowd the last remaining wooden building. In the distance are the trees of Albert Park, the mansions of Princes Street, and, on the skyline, the windmill

Photo: Graham C. Stewart Collectio



associated coal and timber depots mingle with an untidy collection of extensive low iron sheds and two blocks of austere industrial buildings along the waterfront. Further west, structures of single and double storeys accommodate warehouses and factories.

The Shops of Queen Street

Along the ground floor street frontages in the heart of the city are the rows of small retail shops with characteristic wide display spaces and iron verandahs supported by a forest of ornate poles. The sizes of the businesses are almost as diverse as the range of commodities offered (*Fig.* 8). Food shops occupy spacious premises and employ several assistants, and, similarly, the larger clothing stores occupy a whole building. Smaller drapery and apparel shops, along with a host of other retail businesses, including jewellers, stationers, hairdressers, tobacconists, bootmakers, ironmongers and chemists, are located in smaller premises, many of which are one-man concerns. The shop interiors are characterised by a cluttered display of merchandise on counters, on the floor and often hanging from the ceilings. Food lies on benches exposed to the filthy yellow dust that blows in from the unsealed macadam streets. Poorly lit by day, the shops seem even gloomier at night in the pale light of gas or kerosene lamps (*Fig.* 10).

Warehouses and Offices

Commercial warehouses in the lower Queen Street–Fort Street area, grouped near rail and shipping facilities, receive the bulk shipments of imported merchandise and distribute it to retailers in the city and the province. This process often involves a repacking of commodities such as tea, coffee, tobacco and spices, or the reassembling of machinery dismantled overseas before shipment to the colony. The warehouses also act as stores for wool and other goods awaiting export.

Equally important are the business offices of the Queen Street valley. Here the head offices of mining and timber companies, of land agencies and gum merchants, and of shipping and forwarding companies are located on upper floors in apartments conveniently located near the main street. Industries and services elsewhere in the city and province are administered from these offices. The men who operate them comprise a resident commercial population, but they seldom visit the enterprises under their control, for these enterprises may be hundreds of miles from the city. The male clerical staffs are

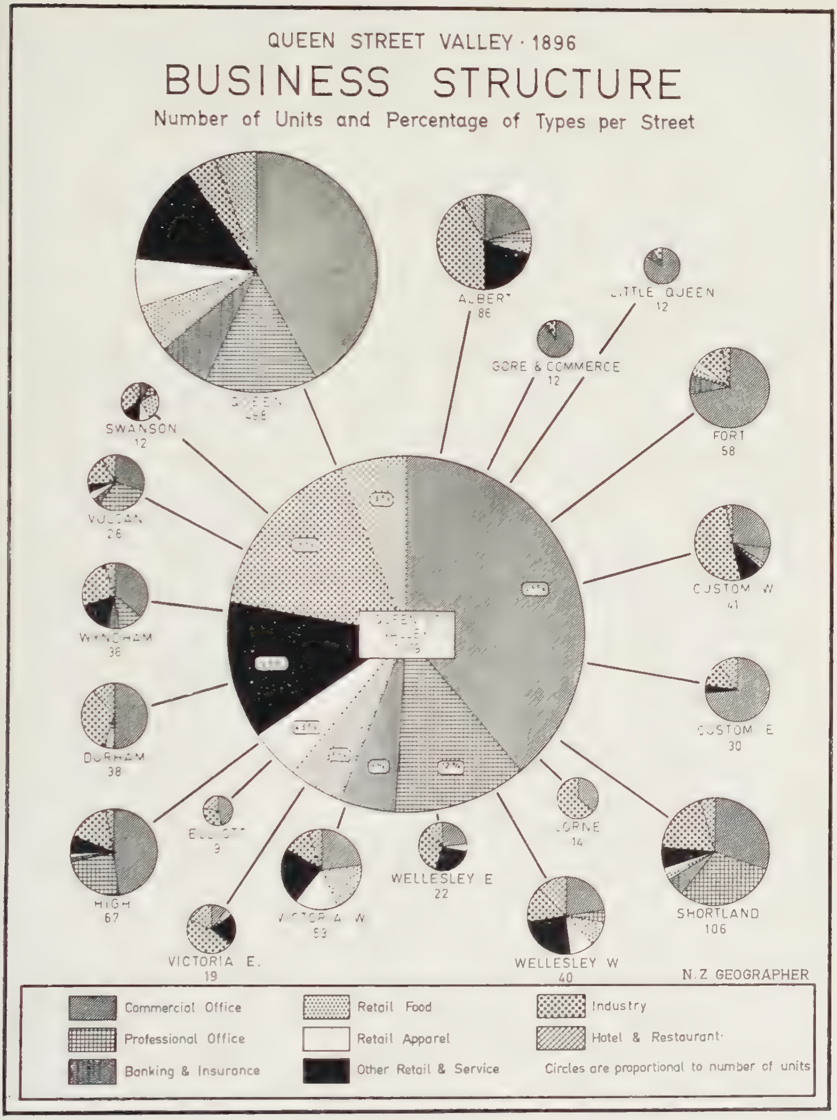


Fig. 8. The business structure of the heart of the city in 1896. Queen Street is the most important street by far, and it is interesting to note the concentration of blacksmiths, plumbers, saddlers and other services in the streets to the west of Queen Street

responsible for the hand-written secretarial and bookkeeping tasks, and a few girl assistants fill catering positions. However, the employment of women is unusual and they have no place in business.

Banking and insurance houses are also located in the Queen Street business area. In most cases these are the only offices of each company in the province, and this itself is an indication of the function of Queen Street as the financial centre for a widely-scattered population. Doctors, dentists, lawyers, accountants, engineers, surveyors and architects are congregated in limited numbers in offices near lower Queen Street, the legal profession concentrating on Wyndham Street, whilst Victoria Arcade in Shortland Street is distinctly favoured by dentists and architects.

Teashops and eating-houses are small and few in number, and are found only in the Queen Street valley. However, the hotels open their dining rooms to the public. The crowded and noisy bars of these buildings, sited with peculiar frequency on the busiest street corners of both city and suburbs, are the favourite meeting place of visiting miners, gumdiggers and townsfolk alike.

While the Queen Street shopping district satisfies a wide variety of needs for the entire city and beyond, the neighbouring shopping centres of Parnell, Newton, Eden Terrace, Newmarket and Ponsonby–Richmond offer commodities such as foodstuffs, hardware and a limited selection of wearing apparel. These suburban shops are less specialised than those in the central area, and each carries a wider range of goods. Services are similarly extended. Small bakeries in these centres deliver bread in covered spring carts to the immediately surrounding areas. Each centre has two or more blacksmith's shops, each occupying a large ramshackle shed fronting the business street, while equally commodious coal and firewood depots satisfy domestic heating demands.

Auckland as an Industrial Centre

According to figures for industry in the colony compiled in the recent 1896 census, Auckland is second to Christchurch with 515 registered factories and 5,260 workers. Industry is in the process of rapid development and new factories are frequently appearing on the scene. The financial slump three or four years ago interrupted development, but now, with the return of prosperity, this former stagnant and relatively unimportant urban activity has become the most vigorous and expanding function of Auckland. The comparatively recent development of these manufacturing units accounts for their small size, both in the extent of their plant and in the numbers employed. Most of them occupy former commercial or residential buildings in the secondary streets of the Queen Street valley and in streets adjacent to the suburban shopping centres, and it is only a few large, older-established industries, such as flour and timber mills, that have the advantage of specialised and expansive structures designed for industrial use.

The number of workers per factory unit varies considerably—from units operated by a single person to a few larger units employing over 200. More than eighty percent of all factories, however, employ between five and fifteen workers, and the nature of production is most frequently geared to the immediate needs of the local and provincial populations. The market for a few specialised industries, such as sugar refining, extends to the rest of the colony and sometimes to the islands of the South Pacific. Clothing, leather goods, food processing, timber working, engineering, printing, gum sorting, coach and boat building, and tanning, in that order, are the most important by numbers employed, and represent processes that can be carried out economically without undue competition from overseas. Gas and steam engines provide power for machinery, but processing in all industries is most commonly effected by hand.

The most important industrial area is the Queen Street valley where all types of manufacturing are represented, but in the areas of lesser importance specialisation is significant. Freemans Bay with its timber mills, gasworks and dock and boat yards sprawled along the seafront appears as an agglomeration of blackened iron sheds, gasometers, logging ramps and timber, and tall smoke stacks. Poorly-formed streets and decayed residences make this part of Auckland untidy and grimy. Mechanics Bay is similar with its large timber mill, clothing and engineering factories and rope works (*Fig.* 5). Three breweries and the railway workshops give Newmarket a distinctly industrial aspect whereas the small leather, food and clothing factories of Newton are unobtrusively located on upstairs floors of shops, or behind them. Other isolated but important factories are the sugar works at Chelsea, the brick works at Ponsonby, the tannery at Richmond and the ammunition works at Mount Eden.

Residential Areas

The homes of the townsfolk are as distinctive as their workplaces. The character of the residential areas has a close connection with their sites on the ridges and valleys of the city (*Fig.* 9). On the promontories of Princes Street and Upper Queen Street, and on the heights of

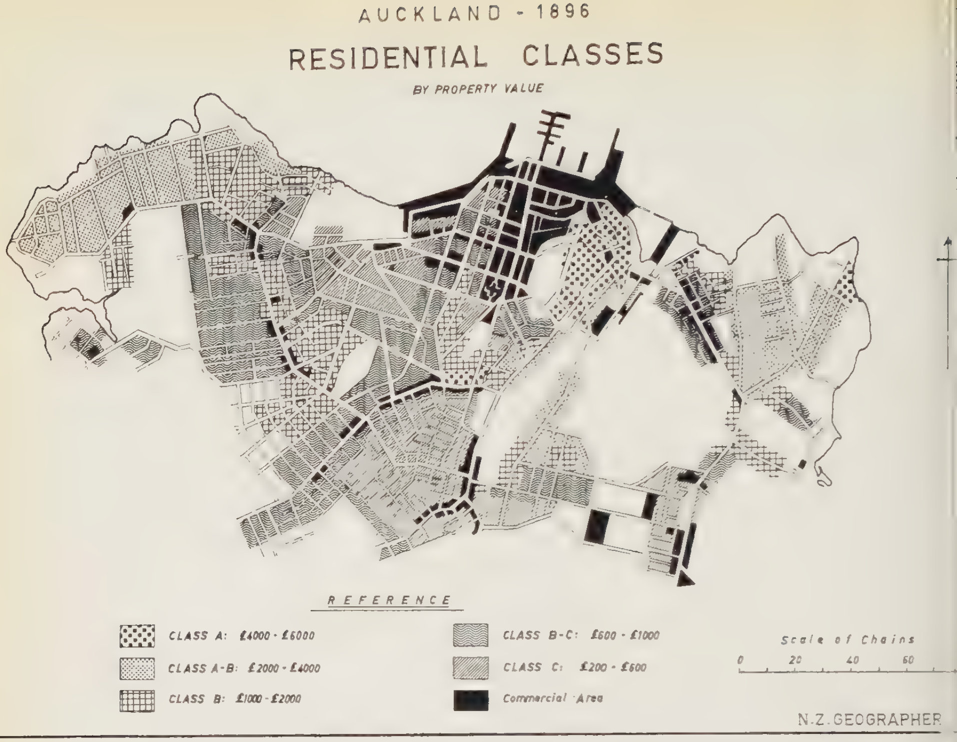


Fig. 9. The residential areas of Auckland in 1896. Class A embraces the mansions of the wealthy in Princes Street and Parnell; Class B represents the villas and bungalows of the 'middle class' situated in large sections on the crests of ridges; and Class C comprises the tiny houses of the workers, usually crammed into the gullies

Grafton, Parnell and Herne Bay, are large two-storey stone and wooden mansions, the homes of wealthy merchants and professional men, while the ridge crests are more closely settled and the 'middle-class' homes belong to businessmen and the smaller merchants. The houses themselves show a considerable variation in style from two-storey villas to single-storey bungalows, all with large ornate verandahs. Construction is mainly of timber, with some brick, and high gabled corrugated-iron roofs are predominant. Mostly, walls are unpainted and stand bare and grey, but an occasional house protected with the reddish tones of haematite lends colour to an otherwise soft grey-green landscape. Together with the reasonably-kept tree-lined streets, tarred and sanded footpaths, and the gardens bounded by whitewashed picket fences, these homes in Ponsonby, Newton and Parnell present a neat and respectable suburban aspect.

The homes of the workers occupy the gullies of Newton, Freemans Bay and Parnell and the Wakefield Street–Alexandra Street area round the Liverpool Street gully. Here the houses are tiny five-roomed single-storey wooden bungalows set close together on a fifth of an acre, or less. They present a dreary scene, crammed along the steep and narrow streets that crisscross the gullies. New houses are being built in all the residential areas, but the greatest activity is in the west along New North Road, Great North Road, Richmond Road and Jervois Road.

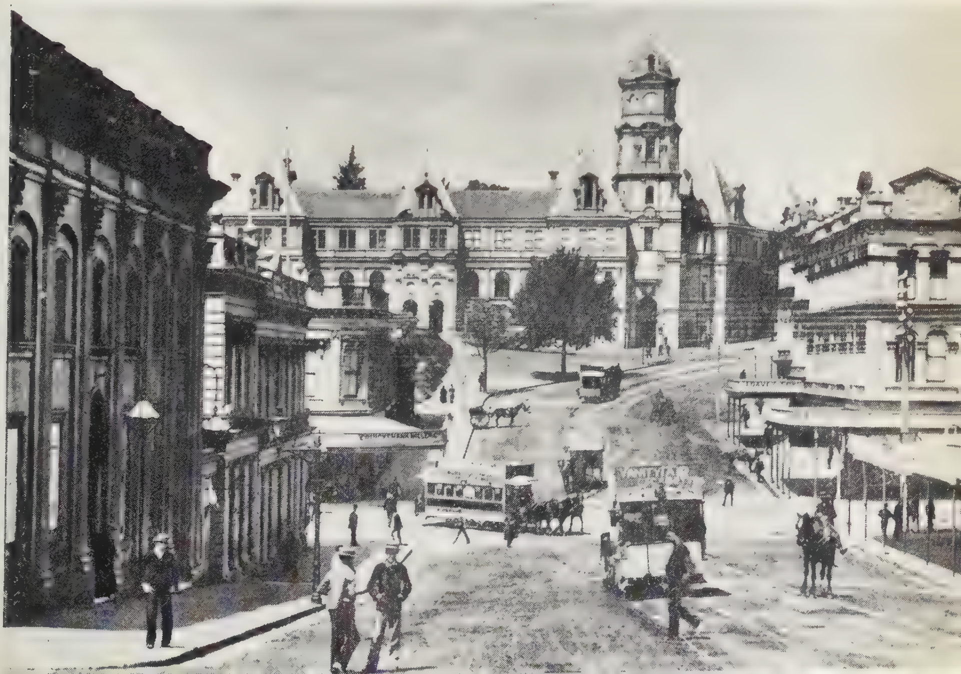
Auckland by Gaslight

Aucklanders depend on gas for lighting and heating in their homes, and on coal and wood ranges for cooking. The streets are lit by incandescent gas lights which cast a shadowy, pale, white light. Each evening, as darkness falls, the lamplighters go about the streets on their bicycles. With nearly four hundred lamps distributed throughout the town, Auckland indeed lives up to its reputation of being the best-lit city in the colony. A municipal water supply from Western Springs serves most of the city, but only a part of the Queen Street valley enjoys a closed drainage system.

Socially, the townsfolk follow a simple and well-ordered pattern of living. Class differences are slight and are based largely on property differences; and on Sundays rich and poor alike dress in their best to attend church together. Most women dress simply in plain black and white dresses with long full skirts, bustles, high starched collars and leg-of-mutton sleeves, but the more fashionable array themselves, in

Fig. 10. The corner of Wellesley Street and Queen Street dominated by the public library in tree-lined Wellesley Street East. This is the Auckland of gaslights, horse trams, macadamised roadways, straw 'cadies' and bowlers, and a leisurely way of life

Photo: Graham C. Stewart Collection



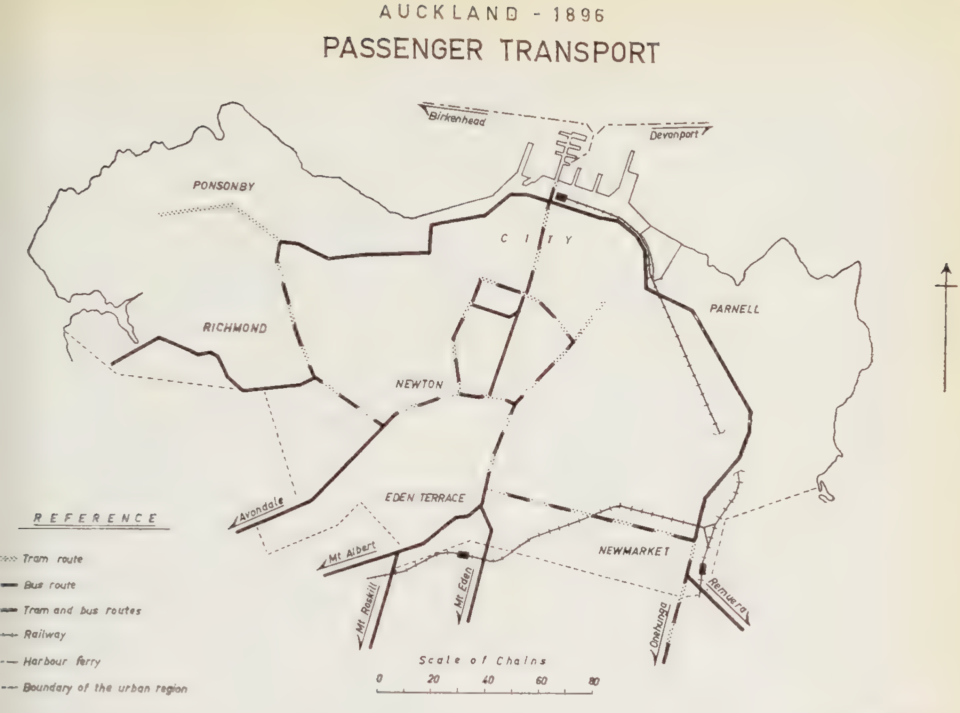
addition, in ostrich-feathered hats, lace shawls and other finery. The men are more restrained in their black jackets and stovepipe trousers, wing collars and bowler hats (*Fig.* 10). There is a definite routine of living from week to week and from year to year, and it seems to match the pace of the time—efficient but leisurely.

Social Life

Auckland is essentially a town rather than a city in the sense that everyone knows everyone else. Public citizens are familiar figures known and respected by everyone, and the two daily newspapers reflect this community atmosphere by the unrestrained personal manner in which they present news. People live and work close together, interests are confined to the necessity of acquiring enough to eat and to the few pleasures created within the family or occasionally afforded by the town. The population is predominantly working class and lower 'middle class'. Wages are generally lower in Auckland than in any other part of the colony, but this is to some extent compensated for by a lower cost of living. The social *élite* comprises a very small proportion of the population, but their garden parties, harbour cruises and musical evenings play a distinctive part in the life of the city. The predominance of young people—from ten to twenty years of age—among the population, and the lack of sufficient recreational opportunities at night, have together given the city a social problem of juvenile depravity. Groups of youths congregate on street corners in the city and in Parnell molesting pedestrians and damaging passing vehicles. During the day large numbers of unemployed loafers and visiting miners and diggers idle away their time on street corners and in hotel bars. Vulcan Lane is a favourite meeting place, for here bookmakers and peddlers operate, and cause a daily traffic congestion for which the police have no solution.

Recreational Facilities

Within the city area the Domain provides the most popular recreational area, and on Sunday afternoons cricket and football matches are attended in season by several thousand enthusiastic spectators. Western and Albert Parks attract hundreds to band performances on Sundays, and bowling greens and tennis courts offer other leisure-time activity. Potters Paddock at Epsom is the principal racecourse, football and show ground, and the annual Agricultural and Pastoral



N. Z. GEOGRAPHER

Fig. 11. Horse buses, seating fifteen passengers, supplement horse trams on all main routes as well as serving the outer suburbs. Trams run a fifteen-minute service to Ponsonby, and a twenty-minute service to Epsom, and fares are threepence and sixpence respectively

Show is attended by an average of 15,000 spectators a day. The harbour is popular for swimming and yachting, and special picnic excursions by paddle steamer operate regularly in the summer months.

Only one theatre has facilities for staging concerts and plays and there are only two smaller halls in the city area catering for public meetings, lectures and entertainment. Clubs, societies and lodges are popular, but people prefer to make their own amusement in a family atmosphere at home and musical evenings are almost a local institution.

The Transport System

Horse-drawn vehicles are the backbone of the transport system of Auckland. All manner of drays and waggons, drawn by teams of up to ten draught horses, crowd the thoroughfares in a disorderly and slow-moving traffic stream conveying goods from one part of the town to another. Passenger transport services are provided by a system of horse trams and horse buses (*Fig.* 11). The trams run from Queen Street to Ponsonby via Pitt Street, and to Epsom via Newmarket. Slow and uncomfortable, and with an average speed of about

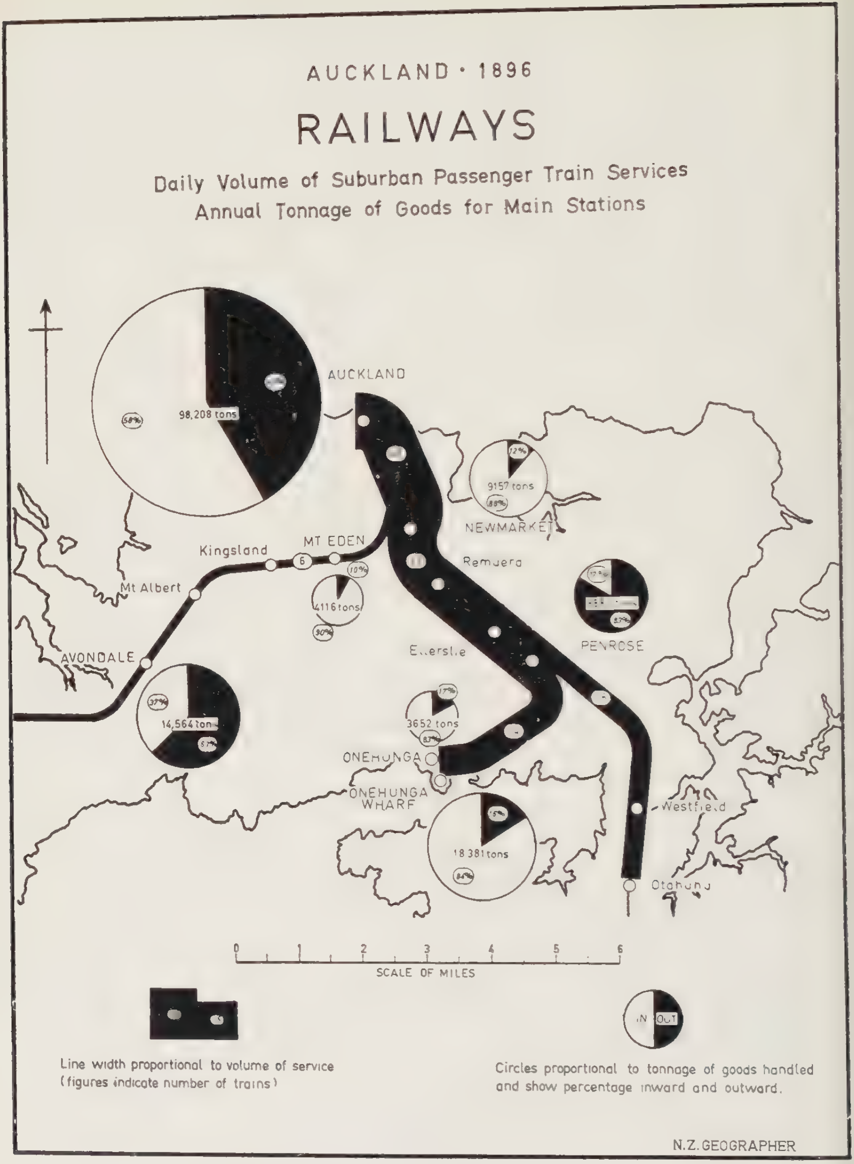


Fig. 12. Minerals, timber and general merchandise make up most of the freight carried by the railway. Scoria and stone are despatched from Penrose and Avondale, and livestock are received at Penrose and Remuera—for the freezing works and saleyards respectively

five miles per hour, they nevertheless provide a cheap and frequent service. The terminus of almost all public transport is situated at the foot of Queen Street outside the railway station. However, probably just as many people as those who ride in tram or bus find their own way to work, and each morning streams of pedestrians and cyclists converge on the Queen Street valley, where in Queen Street itself, traffic is uncontrolled and disorderly, and for this reason appears deceptively dense. Nevertheless, the large numbers of carts, trams, buses and cabs, together with the hordes of barrows, hand trolleys and go-carts being trundled along road and pavement alike, create an atmosphere of bustle and activity.

The railway is more important as an intertown link than as a means of transport within the city. A part of the Auckland provincial system, with extensions to Rotorua, Paeroa, Cambridge, Te Kuiti and Helensville, its suburban traffic is slight, for only three stations—Auckland, Newmarket and Mount Eden—lie within the city area. But in one way, as an interport link between Auckland and Onehunga, the railway is supreme, and goods traffic is heavy on this section (*Fig.* 12). Transharbour ferries connect the city to the north shore suburbs of Devonport, Birkenhead and Chelsea, and other small steamers of up to 500 tons provide regular services to all provincial and colonial ports.

Auckland Faces the Future

Despite these contacts Auckland maintains an outlook of independence and aloofness from the rest of the colony. This is not a vague undercurrent of feeling, but one based on a spirit of loyalty and pride. Comparatively, Auckland is large and its supremacy within its own province is unrivalled. Singularity is one of the many things that makes the city unlike any other in the colony, and yet, at the same time, it emphasises the close interdependence of city and province. Auckland means port, industry, commerce, administration, education, entertainment and a host of other centralised facilities; the province means complementary produce, a ready market and economic and social support. The people still have an attitude of complacency, tradition is valued, and customs are maintained. In dress, thought, family life, religion and social structure, ideas are fixed and conservative, and these same attitudes are expressed in the organisation of the city and in the direction of its development. But enlightenment is in the air, as it were. The possibility of change is accepted, if only by a few, as inevitable; progress is regarded with suspicion rather than rejected. Economic change is imminent; albeit the consequences are undetermined.

GEOGRAPHIC NOTEBOOK

IN THIS ISSUE. The expanding proportion of the population of New Zealand that resides in urban areas is symptomatic of the changing aspects in the economy of the dominion. The four metropolitan centres have continued to grow, particularly Auckland and Wellington, and along with them the second-order cities, particularly Hamilton and Palmerston North. Growth has, in most cases, been accompanied by an extension of economic activity, sometimes the result of changing emphases in the areas served by the towns, sometimes the response to functional attraction within the town itself. In either case the impact on the urban land-use pattern has been significant, and it is this element of change which is studied by Mr A. Grant Anderson, Lecturer in Geography at the Teachers' College, Palmerston North, in his interpretation of the urban geography of what is now the sixth city of New Zealand.

Urban expansion also presents problems, as Mr D. T. Hunt points out in his essay on the geography of market gardening in Metropolitan Auckland. The characteristics of relatively flat land sloping to the sun, shelter from cold weather, ease of accessibility and proximity to an urban centre are the *desiderata* of both housing estates and market gardens, and when the needs of more than 400,000 people must be met, the conflict of purpose becomes very real. The present contribution of Mr Hunt, now teaching at Kelston in Auckland, is based on a thesis prepared by him as a student in the Department of Geography, University of Auckland. It highlights an important element in the urban geography of the largest metropolitan area in the dominion.

Auckland is again the subject in the article written by Mr R. W. Armstrong—an Auckland much smaller, and much more intimate in its way of life, but already beginning to expand as the dairy lands of the 'Waikato' began to take advantage of refrigeration. The Auckland of gaslights and horse trams was soon to disappear, and in this lively and contemporaneous account—again based on a thesis—there is recaptured a facet of a past geography. Mr Armstrong, a former student and member of staff in the Department of Geography at Auckland, recently left for the United States in order further to pursue his studies.

The 'mountain' is known to all in the North Island as a conspicuous feature on the inland road and rail routes between Auckland and Wellington, but few have seen the summit area of Ruapehu as Mr B. E. O'Shea has. His theory is an interesting one, and is as welcome as are his excellent photographs to the literature on vulcanology in New Zealand. Mr O'Shea was trained in the Department of Geology, Victoria University of Wellington, and is now overseas.

The fifth article, by Dr M. B. Dale of B.P. Australia Ltd. at Melbourne, is based on a paper delivered by him to the Adelaide meeting of A.N.Z.A.A.S. held in August 1958. It is of particular interest to New Zealanders in the light of recent proposals to establish an oil refinery in this country.

The notes, commentaries and reviews in this issue were contributed by Mr R. W. Armstrong, Mr B. H. Farrell and Dr G. R. Lewthwaite of the University of Auckland; Mr W. B. Johnston and Mr P. R. May of the University of Canterbury; Mr P. N. D. Pirie of the University of Otago; Professor K. M. Buchanan and Dr R. F. Watters of the Victoria University of Wellington; Professor P. Scott of the University of Tasmania; Mr G. J. R. Linge of the Australian National University; Mr A. D. Tweedie of the University of Newcastle, N.S.W.; Mr G. R. Cochrane of the University of Adelaide; Professor D. L. Linton of the University of Birmingham, England; and Mr R. G. Wilson of Timaru Boys' High School.

AUSTRALIAN RESOURCES IN MAPS. In 1958 the Australian Department of National Development published in Canberra five additional maps to the *Atlas of Australian Resources*. This important step forward brings the total number of published maps to twenty-five. A further five are planned to complete the atlas. The new maps are entitled 'Dominant Land Use', 'Population Increase and Decrease (1947-1954)', 'Ports and Shipping', 'Education Facilities', and 'Health Services', each map being accompanied by an explanatory handbook.

Once again the compilers have shown unusual skill in handling the presentation of cultural aspects of commonwealth life and landscape, for Australia, with so much of its human activity crammed into a small part of its total area, is undoubtedly a cartographer's nightmare. These maps, on a scale of 1 : 6 million conform to the scale and high standards of compilation and draftsmanship of earlier maps in this series. The symbols and colouring on the maps, and their legends, allow easy reading of even such detail as the number of berths, and the depth of water at the deepest of these, in the Australian ports.

The map of dominant land use presents a theme which is familiar to students of Australian geography, although its presentation in this form has been long overdue. The pattern of Australian rural activity is well shown, and in a detail not previously attempted. The significance of pastoral activities in the Australian rural economy is underlined by the large areas tinted for beef cattle and sheep, though superimposed symbols distinguish the varying forms of these activities—breeding, breeding and fattening, intensive breeding and fattening in the case of beef cattle; wool, wheat or other cereals with wool and fat lambs, wool and fat lambs in the sheep areas. The areas devoted to dairy cattle, sugar cane, timber and intensive rural production (such as vines, fruit and tobacco) are separately identified. The accompanying commentary by A. J. Rose reviews the general physical and historical background to this land-use pattern, and discusses current problems.

In the text accompanying the map of population increase and decrease in the period 1947-1954, W. D. Borrie and R. M. Dedman draw attention to the significance of these intercensal years in Australian demographic history—a period showing the full effect of the postwar immigration and high birth rate. The map distinguishes between the urban and rural increases and decreases in the fashion of the earlier map for the period 1933-1947, though unfortunately the values of the symbols shown in the legend are not strictly comparable. The commentary, with its eleven tables and one figure, gives a much more detailed analysis of the demography of the period. The changing age structure and its effect on employment, the occupational distribution, the changes in distribution by states, and the patterns of urban-rural movement are all reviewed with frequent reference to previous intercensal patterns, and in particular to the preceding period and the earlier map. A striking feature is the almost total absence in 1947-1954 of the rural depopulation in southeastern Australia which was such a feature of the 1933-1947 map. The changing patterns of population within the metropolitan areas for the years 1947-1954 are shown in six separate maps which accompany the text.

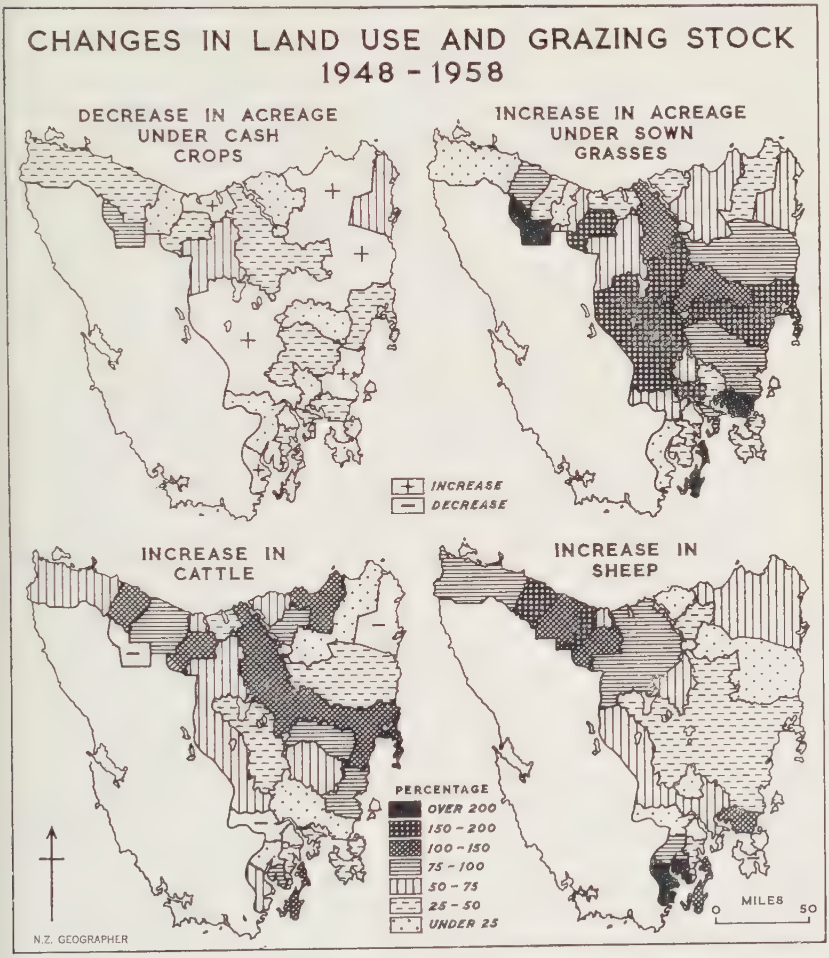
Perhaps the most fascinating map in this series is that on ports and shipping. The text by L. N. Etherton and L. T. Kelley gives a good account of past and current trends in port development. The map contains a wealth of information. Not only are the tonnages of imports and exports for 1954-1955 quantitatively indicated, but overseas and local movements are distinguished and the relative importance of the types of cargo differentiated. Varying symbols, moreover, classify the relative importance of ports in terms of the number of berths and the deepest water alongside, and of the arrivals and departures of passenger traffic, both overseas and local. All this is achieved with an amazing clarity of presentation. And finally, an attempt is made, in terms of the rural produce handled, to identify the extent of the hinterlands of the individual ports. There is a great deal of interesting material in this—how the border between New South Wales and Queensland acts as an effective divide whereas that between Victoria and New South Wales is overridden in the Murray Valley to the advantage of Melbourne; or how the state wool sales in Brisbane allow the hinterland of this port to extend north and west through the Queensland sheep districts to overlap with the hinterlands of Rockhampton, Gladstone and Townsville.

As might be expected, the two maps of educational and of health facilities reflect the distribution of Australian population, though in the latter case the activities of the Flying Doctor service means the appearance of symbols over a wider area than appears for educational facilities. The compilers have done well to meet this situation. Commentaries by the commonwealth authorities responsible for these two aspects of Australian life point to the details of organisation and development, and in their supplementary maps show the distribution of these facilities in the capital cities and Newcastle.

These maps and their commentaries form separate documents, but between them several interesting correlations can be traced. For example, the increasing tempo of Australian industrial life in the postwar years, which is mentioned in the study of population changes, is reflected in the increasing number of establishments for technical education. Together with the other maps already published, and with those projected, these maps and their supporting texts are essential documents in any study of the geography of Australia.—A. D. Tweedie

CHANGES IN TASMANIAN AGRICULTURE, 1948-1958. In recent years the Tasmanian Branch of the Commonwealth Bureau of Census and Statistics has greatly extended its analysis of the annual stock and crop returns. Its latest publication, *Production Statistics: Primary Industries, 1957-58*, contains a wealth of detail concerning, *inter alia*, the two most distinctive features of Tasmanian agriculture today—the trend from cash-crop farming to increasing dependence on grass, and the growing intensification of both arable and grassland farming.

Cash-crop farming in Tasmania has been largely based on the specialties of potatoes, tree fruits, small fruits and hops. In the 'thirties the potato acreage had remained fairly constant at about 36,000, but under the stimulus of wartime demand, it rose to 81,000 in 1945. Since then the mainland markets for Tasmanian potatoes have steadily contracted, and accordingly the acreage slumped to 19,125 in 1957, the lowest since 1893. In 1948 it had been 40,380; in 1958 it was 21,600. Similarly, from 1948 to 1958, the acreage under orchards, which had been declining slowly since 1922, fell from 25,970 to 20,660, while the acreage under small fruits, which had reached a peak of 5,390 in 1946, slumped from 4,770 to 2,350. Since 1948, no less than two-thirds of all the plum trees in the island have been grubbed up (plums are no longer in much demand for jam manufacture), and along with them one third of the pear trees, one fifth of the apricot trees, and one fifth of the apple trees. Moreover, about four-fifths of the 1948 acreage under gooseberries has been grubbed up, as well as about one half of each of the blackcurrant, raspberry and strawberry acreages. Hops, alone among the specialties, have shown an expansion, the 1958 total of 1,440 being 180 more than ten years ago and only fifty short of the 1925 peak.



Specialised agriculture is largely concentrated in the northwest and the southeast. In the decade 1948-1958, the decline in cash-crop farming was particularly marked in the potato-growing districts of the northwest and the lower Midlands, in the orcharding districts of the West Tamar, the D'Entrecasteaux Channel, the east Derwent and the east coast, and in the grain and pulse region of the north Midland plain and the Westbury-Deloraine corridor. Although the acreage under grain and pulse crops has generally remained much the same over the past two decades, there has been some significant redistribution. Thus, the decline in potato growing and orcharding in the Devonport and Latrobe districts has been more than made good by the expansion in green-pea cultivation for the Devonport cannery and in barley cultivation on the black soils of Sassafras. Similarly, the increase in cash-crop acreage in the upper Derwent and Campbell Town districts is largely attributable to a greater emphasis on oats in association with pasture development, whilst in the northeast a decline in potatoes and apples has been more than counterbalanced by the development of green peas and other vegetables for canning at Scottsdale. In the apple-growing districts of the Huon, Bruny Island and the Tasman peninsula, the decline in cash-crop acreage has been less marked than in most other specialised areas, whilst in the extreme south of the Huon, where the forest around Dover has receded to make way for new plantings, the acreage has even increased.

While the area of cropland fell by one eighth, to 301,000 acres, in the decade under review, the area under sown grasses and clovers more than doubled—to 1,233,860 acres. All farming districts shared in this development, but expansion was greatest in the Midlands and the upper Derwent Valley. At the same time, the topdressing of pastures increased threefold. As a result the cattle population rose by more than fifty percent (dairy cattle, forty-two percent to 205,000; beef cattle, sixty-six percent to 167,000) and the sheep population by about sixty percent to 3,298,000. The greatest expansion in dairying took place in the northwestern and northeastern potato-growing and mixed-farming districts and among the West Tamar orchards, while beef-cattle development was largely concentrated in the north Midlands and along the east coast. The relative expansion of sheep rearing was likewise greatest in the northwest and the southeast, both areas of specialised agriculture and mixed farming, but the absolute growth in sheep numbers was of course greatest in the Midlands and the northeast. A noteworthy feature of the decade was the relative decline in crossbreds (from fifty-one to twenty-eight percent), merino comebacks (from fourteen to thirteen), and merinos (from fourteen to ten); the increase in corriedales (from nine to fourteen); and the emergence of polwarths (with an increase of from nine to twenty-nine percent) as the principal breed.

These changes in arable and grassland farming, which have been stimulated by changing agricultural prices, have also involved a marked intensification of agricultural production. In mechanisation the decade witnessed a fourfold increase in the number of tractors (horses declined by fifty percent), a threefold increase in milking machines, and a doubling in the number of shearing machines. The acreage irrigated rose by more than a half, and even a very limited extension of irrigation to the potato crop raised the average yields per acre by a third. In 1958, despite the reduced orchard area, a bumper crop of apples and pears was harvested. (See *Geography*, Vol. 44, Pt 1, February 1959, pp. 47-49.) Furthermore, over the decade the output of each of the main pastoral products—wool, butter, beef and lamb—roughly doubled in quantity, only cheese showing a slight decline; even honey production more than doubled. This greatly-expanded productivity has derived from an extended agricultural area (the acreage rose from 6,183,475 to 6,547,000), but from fewer holdings (the number fell from 11,850 to 11,390) and from fewer men on the land (the number working full-time fell from 16,040 to 13,960).—PETER SCOTT

DEVELOPMENT IN TROPICAL AUSTRALIA. The recent proposal to spend £A 5 million in the East Kimberley area shows an increasing awareness by the Commonwealth Government of the need for the development of the Australian Far North. The 400-mile-long Ord River is to be harnessed by the means of two dams: a large diversion dam across Bandicoot Bar, sixty-two miles from Wyndham, and a larger dam some forty miles further upstream. These projects will bring an estimated half million acres of potentially irrigable land into production. The light-textured red soils near the river, and the much larger area inland of black clay soils on flat treeless plains, will be irrigated, bringing about a new era for East Kimberley with an emphasis on tropical agriculture.

The first part of the Ord River scheme is to be the construction of the diversion dam with a storage capacity of 40,000 acre-feet. Water from the dam will irrigate a self-contained scheme of 10,000 acres of land. Initially four pilot farms of 1,200 acres each, situated a few miles downstream, will be used for the commercial cultivation of crops. These experiments will be carried out by the staff of the Kimberley Research Station. If this scheme is found to be economically sound and the soils of the Ord River valley suitable for irrigated tropical agriculture, the main dam project will follow.

Survey work on levels, on the diversion channel for contour irrigation, on the rock basement, and on the suitability of river sand for use in concrete began in June 1959. Tenders for the construction of the diversion dam are to be called before the end of the year, and construction will take about two years. Because of the rainy season when transport is almost impossible and the problem of flooding from the fast-flowing Ord River is serious, construction work on the dam will be possible for only five months of the year.

The site of the diversion dam is a bar of hard grey quartzite rock, and 100,000 cubic yards of concrete will be required for the walls which will be approximately 1,500 feet across and will rise fifteen feet above the rock bar. The cost of the diversion dam will be £A 2,500,000.

The second and bigger stage in this ambitious programme of harnessing the Ord River and its tributaries will be the construction of the main dam, which will have a top width of 1,000 feet, will be 130 feet high, and will have an ultimate storage capacity of 3,000,000 acre-feet. A giant underground hydroelectric power station is planned, which will supply power to the numerous surrounding small farms that are part of the scheme. From the main dam to the diversion dam, forty miles downsteam, the river will have a fall of three feet per mile, and this will permit a ready flow in the gravity-fed contour channels which will distribute the irrigation water.

Paralleling these developments are active plans to extend and improve the port facilities of the area. £A 700,000 is to be spent on a 564-foot extension of the jetty at Wyndham. Work began in June 1959. When completed at the end of 1960 there will be wharf berthage at the same time for a 500-foot overseas vessel and a smaller vessel.

A large sum has been approved for developing a new deepwater port between Broome and Derby. Several sites are being investigated. One possible site, Entrance Point, near Broome is not greatly favoured. At Derby it would be necessary to extend the present wharf 11,000 feet to bring it to the deepwater channel. In addition, five million cubic yards of material would have to be dredged, at a cost of ten shillings a cubic yard, to enable even 10,000-ton ships to berth at the extended wharf. The third site being investigated is at Black Rock, thirty-four miles north of Derby. This site has natural deep water, but a mile-long causeway will have to be built across marsh and mangrove mudflats before the wharf proper could be commenced. A road has been cut through to Black Rock, and if this site is chosen, the road will need to be sealed at an estimated cost of £A 9,000 per mile.

This awareness of the great need for large-scale coordinated development is an encouraging step. Here in East Kimberley, at least, Australians may be able to answer critics who have claimed that Australia is doing nothing to populate and develop its great empty tropical lands. But, more important, these developments envisaged for the near future may well be more far-reaching and of considerably greater importance than the mere establishment of a new productive area.—G. ROSS COCHRANE

THE COAL PROBLEM. At a time when coal appears to be progressively losing ground to both electricity and oil, and at a time when some coal-mining communities in New Zealand are beginning to show signs of distress because of this decline, it is interesting to see the mounting literature attempting to point up some of the problems affecting the coal industry. A number of publications, popular and technical, have presented the virtues of coal to the consuming public, have shown the contribution of coal in relation to other forms of energy, or have examined the industry with a view to putting forward reasoned recommendations in the hope that some of the numerous problems might be solved.

At the Mining Conference in Dunedin, 1953, Buchanan presented a paper quantitatively comparing coal with other sources of energy. This was extended by Outhwaite at the Mining Conference of 1956, which was dedicated to coal utilisation. Recently, too, a new popular magazine *New Zealand Coal* has been keeping the public informed; and through a number of channels, Toynbee of the Dominion Physical Laboratory has been focusing attention on methods of coal gasification applicable to New Zealand. Concern for the efficient utilisation of New Zealand's domestic power resources, and especially for the best possible uses to which local energy sources may be put, is a worthy objective.

The latest contribution to the problem is D. S. Nicholson's 'Utilisation of Coal in New Zealand 1920-1955', published in 1958 as the *D.S.I.R. Information Series No. 19.* The first part of the bulletin discusses coal resources, coal in relation to other kinds of energy, the efficiency of utilisation of various sources of power, and the rank of coal in New Zealand.

The second half of the publication is concerned with the transport, distribution and use of coal. Particular attention is paid to an analysis of costs. The section on transport and distribution costs is particularly illuminating and has direct bearing on West Coast mining areas. At a time when coal is struggling to maintain a place among the important sources of energy, freight rates have more than doubled. In 1946 a ton of coal was carried from Westport to Wellington for 13s.6d. In 1955 freight on the same amount cost 43s.0d., an increase of 222 percent. Nicholson states categorically that there 'appears to be no justification' for the 'anomalous higher rates for bituminous coal'.

Among the recommendations are several suggested ways of reducing the price of coal; an expressed hope that imported oil might be taxed in the same way as coal, or that alternatively both might be put on the same footing; a plea for greater efficiency in firing devices; and an improvement in the fuel produced and in the service given the consumer.

The bulletin is a worthwhile contribution to the general literature on coal in New Zealand and is worth purchasing for its comprehensive statistical tables and graphs alone. These picture coal in comparison with other energy sources in a more favourable light than has ever been the case before and result from Nicholson's interesting new analysis of efficiency of energy use in New Zealand.—BRYAN FARRELL

THE CASTLE HILL BASIN. As a result of research, partly by members of the New Zealand Forest Service Range and Experimental Station, Ashley Forest, but mainly from fieldwork by Mr C. J. Burrows in the summer of 1958-1959, some further observations can be made on the vegetation of the Castle Hill Basin. (See two articles by D. H. Relph in the *New Zealand Geographer*, Vol. 13, No. 1, April 1957, pp. 41-55, and *ibid.*, Vol. 14, No. 2, October 1958, pp. 131-146.)

It is pointed out that recently there have been some changes in the animal population of the basin. Chamois appear to equal deer in numbers on the Craigieburn Range, and opossums have increased considerably in the forests. Although cattle have been removed from the Broken River area below Mt Torlesse, deer and pig infestation appear to have increased considerably, and the forests there still lack any regeneration or undergrowth.

Concerning the species composition of the plant communities at present, it is suggested that two species briefly mentioned by Mr Relph have been incorrectly identified. These are, in the tall-tussock grasslands, *Danthonia australis* (possibly members of the *Poa colensoi* complex, or *D. setifolia*), and in the short-tussock area, *Celmisia laricifolia*, which is rarely found below 4,500 feet. While *Poa caespitosa* communities are not common above 1,900 feet, some areas of this plant have been found as high as 3,000 feet on spurs of the Torlesse Range above the Broken River.

As far as the pre-European vegetation is concerned, it is considered that while *Angelica montana* may have been common in localities such as wet rock, bog and moist streamsides, it is doubtful that it could have survived in the harsher environment of the short-tussock grassland proper.

Perhaps the most interesting observations relate to the extent of former forests. Mr Burrows has been concerned with the distribution of ancient forests—in many cases probably destroyed before man entered the basin. Charcoal in soil profiles has contributed to the conclusion that beech forests once covered most of the Castle Hill Basin, apart from an area of short-tussock grassland on the lower flats. It is considered that *Festuca novaezelandiae* is only common in the snow-tussock community as a result of burns—either recent or ancient bush burns. Similarly, *Dracophyllum uniflorum* is also regarded as an indicator of the presence of former forest, and appears to have increased after burning. Finally, Mr Burrows considers that the timberline lies approximately at 4,500 feet, and that where it is lower, it has been lowered by fire at some time

THESES IN GEOGRAPHY. During 1958 seven theses were presented for masterate degrees in geography in the University of New Zealand. Now that each university institution has a measure of autonomy in the organisation of degrees within the University of New Zealand, regulations for the presentation of theses vary slightly. Accordingly, in future, notification of thesis titles will be at regular intervals and will not necessarily refer to the year of presentation.

Theses presented in 1958 at the University of Auckland were:

Auckland in 1896, An Urban Geography, R. W. Armstrong;
Manufacturing in the Waikato, G. T. Chandler;
The Towns and Tributary Regions of the Central North Island, J. P. Millar;
Viticulture and Wine Making in New Zealand, Its National and Regional Character, W. Moran;
The Coromandel Peninsula, Three Essays in Historical Geography, P. Jean Nicholls.

At the University of Canterbury two theses were presented:

Churches in Metropolitan Christchurch, A Study in Urban Geography, R. Coates;
An Historical Geography of a Hawkes Bay Region, A. C. Yule.

These theses are housed in the respective university libraries.

THE NEW 'QUARTER-INCH'. The first sheet in a new series of topographic maps, N.Z.M.S. 18, has been published by the Department of Lands and Survey. Drawn to a scale of 1 : 250,000, the series will cover New Zealand in twenty-six sheets. Formerly, the old N.Z.M.S.10 Territorial Series on a scale of four miles to the inch, long overdue for revision, of limited topographic value, and using a greater number of odd-sized sheets, offered the only complete coverage of New Zealand on such a scale. The new N.Z.M.S.18 is therefore a welcome addition to the range of New Zealand topographic maps, providing a wealth of information at a scale between that of the N.Z.M.S.1 (1 : 63,360) and the N.Z.M.S.19 (1 : 500,000) series.

In format and general appearance it resembles N.Z.M.S.1, and in quality of production and range of information it is not inferior to the British Ordnance Survey and United States Geological Survey topographic maps on the same scale. The most striking innovation is an overprint in tones of grey to give a three-dimensional effect to relief. This 'plastic' hill shading is additional to contours which are printed in a clear red line at 500-feet intervals, and combines a quick visual appreciation of landforms with the related quantitative data.

On this first sheet in the series, that of Christchurch, the representation of Banks Peninsula in relation to the Canterbury Plains is most effective. Spot heights and mountain peaks are indicated by the use of a sans-serif type face which helps to distinguish them from other names. All other lettering is in a clear serif face, but it is unfortunate that the usual distinction made between roman type for cultural features and italic for natural features has not been followed strictly. Water features are indicated in an italic blue, and this distinguishing clarity is shared by the features themselves. Vegetation is shown either as native bush or as exotic plantation, but the shade of green used, and the pattern of the symbols themselves, fail to stand out clearly against the grey tones of the 'plastic' hill shading.

A similar, but less serious weakness, is the shade of yellow used for roads. Again the colour does not contrast with its background as much as could be desired. Main and secondary roads are distinguished by width of line, and although no confusion exists, the extreme exaggeration of the width of the roads gives a sense of coarseness to the draughting which could have been avoided by using two colours and finer lines. Incidentally, the use of red for main roads and a brighter yellow for secondary roads, as on the British Ordnance series, would have greatly improved the appearance of the map, which is rather colourless as it stands.

A useful feature is the indication of urban population by a variation of type size and case for town names, using five categories: cities and towns 7,000 to 20,000; towns 1,000 to 7,000; towns less than 1,000; and localities. The choice of 7,000 as the dividing figure between large and small towns is a good one, for approximately the same percentage of the total urban population occurs in each group.

Railways, main electric-power lines, mines and the boundaries of national parks and land districts are also shown, as well as other minor features. A reference grid in 100,000 yard squares and latitude and longitude scale has been provided, while, outside the map frame, the legend, scales and printed information are arranged at the base of the sheet. It is pleasing to note the inclusion of a coverage diagram indicating maps of other scales covering the same area, and a sheet location diagram overprinted on a small outline of New Zealand. An unfortunate omission is the indication of true north and the magnetic declination except in the form of a statement.

Altogether this new series will be most useful for teacher, student and the public alike. With several sheets arranged together, the maps could be used to advantage in the general study of landforms, whilst the amount of topographic detail shown would also make them especially valuable in regional studies.—R. W. ARMSTRONG

CORRIGENDA. Professor V. J. Chapman has written to the Editor asking that two items be emended in his article, 'The Geographical Status of New Zealand Lowland Forest Vegetation' which was published in the *New Zealand Geographer*, Volume 14, Number 2, October 1958. On page 106, *Metrosideros umbellata* in line 1 should read *Metrosideros robusta* whilst *P. nivalis* in line 17 should read *P. hallii.*

IN OUR CONTEMPORARIES

In New Zealand and Oversea Journals . . .

Relief Patterns in New Zealand and Western Europe

DISSECTION AND REDISSECTION OF THE WELLINGTON LANDSCAPE: C. A. Cotton, *Transactions of the Royal Society of New Zealand,* Vol. 85, Pt. 3, 1958, pp. 409-425.

ALTERNATING PLEISTOCENE MORPHOGENETIC SYSTEMS: *idem, Geological Magazine,* Vol. 95, No. 2, 1958, pp. 125-136.

The first of these two papers, prepared for a New Zealand journal, describes some characteristics of the landscapes of the Wellington peninsula, points a contrast with the landscapes of western Europe, and draws some conclusions that may bear on such general geomorphological concepts as corrasion by running water and theories of downwearing. The second, published in London and addressed primarily to geologists in the United Kingdom and United States, is concerned with the same basic facts, but they are presented as part of a discussion on the work of alternating phases of 'normal' and 'cryergic' erosion processes during Pleistocene times. They are thus both overlapping and complementary.

A notable feature of the Wellington hills is their 'fine-textured feral dissection'. 'Fine-textured' implies close spacing of stream channels; 'feral' is used by Professor Cotton to imply that the divides are not rounded but sharp-edged or 'unsubdued', and seems synonymous with Davis's 'serrate'. Professor Cotton recognises that some fine-textured landscapes display a measure of 'small-scale' rounding of ridge crests, but feral ridges are quite commonly associated—for example, in California and Japan as well as New Zealand—with fine-textured dissection. Without doubt such feral ridges are produced by the intersection of what Professor de Bethune of Louvain would call 'valley slopes'—that is, slopes experiencing vigorous downhill movement of rock waste towards an actively-eroding stream. Fine-textured feral relief in the Wellington hills is thus related by Professor Cotton to active work by rain and rivers. But he demonstrates also that the present relief is of very recent creation. Abundant sheets and *coulées* of soliflual material mantle many spurs and fill 'fossil gullies' that are perched on spur ends. They witness to a period of earlier fine-textured relief largely filled and obliterated in a phase of gelifraction and solifluction before the present gullies were initiated on new lines and cut more deeply than the old. He thus envisages an alternation of phases of 'normal' operation of rain and rivers, and of phases of cryergic processes.

Similar alternations are known to have taken place in western Europe, but the present landscapes, in contrast, are coarse-textured and subdued. Professor Cotton accepts the view of Dr M. T. Te Punga that southern England has a 'typically periglacial landscape', and Professor Jean Tricart's attribution of the subdued landforms of much of France to cryergic processes. He concludes that while 'in New Zealand intercryergic morphogenesis has obviously been dominant despite abundant evidence at Wellington of Pleistocene gelivation and solifluction . . . . in southern England and western Europe . . . the cryergic processes were successful in "subduing" the landforms'. This conclusion may have some validity as regards the forms of the divides, but it is less obvious how cryergic processes can change the texture of dissection of a countryside, unless many valleys are suppressed by being filled by soliflual material and not reopened during redissection. Such infillings are not unknown—the classic Black Rock section at Brighton on the south coast of England and the West Dale valley in Pembrokeshire have infillings scores of feet thick—but Professor Cotton cites Tricart's view that in France the fossilisation of the ravined landscapes of interglacial times under soliflual material is very rare, and the same may probably be said for southern England. In order to explain this rarity of buried valleys Professor Cotton assumes that 'much of the evidence of such fossilisation may either be removed by later (intercryergic) erosion or "shaved" away in later cryergic ages', and, further, that any valleys 'thus infilled in Europe would most probably be wider and part of a coarser network than Wellington gullies, owing to a tendency, perhaps controlled by lithology, to develop coarser dissection'. This is certainly an important point. Texture of dissection in central and western Europe has long been demonstrated to vary from outcrop to outcrop and to be primarily related to the permeability of the rocks concerned.

The contrast, which Professor Cotton highlights, between his 'New Zealand' fine-textured feral landscapes and his 'West European' coarse-textured subdued landscapes, is certainly most striking to the eyes of a European visitor to the Wellington hills. But 'New Zealand' landscapes are not ubiquitous in New Zealand, and the present writer has also been struck by a dissection pattern of very different character with youthful, apparently rejuvenated, valleys which are parallel-sided, widely-spaced, with infrequent tributaries heading bluntly in dimple-like hollows, and separated by broad-topped convex divides often ending in spatulate spurs. Such terrain is characteristic of the 'downlands' north of Balclutha where the contrast between valley and spur forms is commonly accentuated by the pattern of cultivation, and of the uplands between Maungatua and the Hindon gorge of the Taieri River. Though possibly not too easily matched in Europe, these landscapes are 'west European' in Professor Cotton's sense, and may possibly have been subdued by cryergic processes and immaturely redissected. In contrast again is the landscape of the Upper Shotover basin, probably no finer in texture of dissection but decidedly feral, and well characterised by Park as 'tent topography'. Gelivation and solifluction should not have lacked influence in this subalpine region.

To the writer it would seem that some of these differences within New Zealand, and particularly the contrast between the landscapes of Wellington and western Europe, are most explicable in terms of available relief above local base-level. Tectonic activity in Wellington has raised the old peneplain (K Surface), from which the landscape is believed to have been carved, more than 1,600 feet since mid-Pleistocene times. Available relief may have increased as rapidly as valley deepening, resulting in a state of almost continuous rejuvenation with vigorous ablation from the slopes of the deepening valleys. Over large tracts of southern England and northern France the landscape has been created by the dissection of an upraised marine platform of earliest Pleistocene date that is still no more than 650 feet above the sea. Uplift has been discontinuous and interrupted by periods of stillstand and partial planation of at least the soft-rock outcrops, while many of the hard-rock uplands, being of permeable sandstones and limestones, have probably always had coarse-textured valley patterns. Uplift or redissection of the base-levelled floor of a clay vale by only one or two hundred feet would require a phenomenally high stream density to result in the development of feral divides.—DAVID L. LINTON

REVIEWS

A View of Eighteenth-Century New Zealand

SIR JOSEPH BANKS IN NEW ZEALAND, FROM HIS JOURNAL. Edited by W. P. Morrell. Wellington: A. H. and A. W. Reed, 1958, pp. 159, 21s.

Much of the most valuable information on early New Zealand has remained embedded in relatively inaccessible volumes confined to the shelves of a few libraries. The publication of the relevant portions of Sir Joseph Banks's Journal—designed as a companion volume to *Captain Cook in New Zealand* published in 1951—is therefore particularly welcome. It is perhaps the most perceptive account of the contacts of the first Europeans, barring Tasman, with virgin New Zealand.

Professor Morrell's introduction is invaluable—a succinct outline of Banks's life and work which indicates the many facets of the times which he influenced. As scientist-explorer, as friend of the court, as President of the Royal Society, and as adviser on the colonisation of Australia, his impact was exceptional. His capacity to win the friendship of native peoples eased the difficulties of Cook's first Pacific voyage, but it was particularly fortunate that Banks had, as Morrell states, a 'universal curiosity' as well as 'greater artistic perception and a more graphic pen than any visitor to New Zealand for many years to come.' His observations, some of which have been wrongly ascribed to Cook, incorporate much lively information on people and places, information significant for the historical geographer as well as for historian and anthropologist. With candour and humour Banks describes the demonstrative but tentative aggressiveness of the 'Indians', their villages, houses, cultivations and foodstuffs, fortifications, weapons and warfare, arts and burial customs, and even includes some comparative language study. The text is interspersed with a selection from Parkinson's plates, chiefly illustrative of native plants and Maori life.

The journal thus makes good reading, but there are some disappointing defects of production. It is admittedly common practice to maintain the detail of the original text and thus preserve the antiquarian flavour, but simple emendations of spelling and punctuation to conform with modern usage would have made for easier and wider reading and would have eliminated the sometimes distracting task of unravelling the meaning. Furthermore, though a valuable series of footnotes does much to identify birds and plants, as well as some place names, much would have been clarified by the incorporation of further specific locational information. The only map included is that by Captain Cook, reduced to the point where the smaller print strains the eyesight. A large-scale, up-to-date map, designed to enable the reader to trace the exact route and match the verbal descriptions with precise locations would have been invaluable. Furthermore, the editor's remarks that Banks was hampered in his observations on population distribution and social organisation are disappointingly meagre. It would have been helpful, particularly for the layman, had the points of agreement and especially divergence between the opinions of Banks and later investigators been defined more specifically. But notwithstanding such omissions, the publishers have done good service in placing this handy and informative journal in the hands of the reading public.—G. R. Lewthwaite

BEGINNINGS IN CANTERBURY

A HISTORY OF CANTERBURY, Volume I: To 1854. Edited by James Hight and C. R. Straubel. Christchurch: Whitcombe and Tombs Ltd., 1957, pp. 287, 22s. 6d.

It is a very great pity that both editors of the long-awaited history of Canterbury have died since the appearance of the first volume of that work. Geographers and historians alike will share the deep regret that neither Sir James Hight, doyen amongst New Zealand historians, nor Mr Straubel, a younger historian, editor and former civil servant, were able to see the history completed. Its progress has been dogged by a succession of misfortunes and misadventures.

But Volume I promises well. Mr Straubel's careful archival research on the pre-European and earliest European settlement of the plains and of Banks Peninsula is represented in a readable and interesting, if not very penetrating, narrative of the history of the Maori and the whalers, of the French at Akaroa and of the early English, Scottish and Australian pioneers. Mr Webb traverses more familiar ground—the origins, founding and eventful early years of the much-studied settlement of the Canterbury Association. His brief analysis, whilst offering little that is new, forms a rounded and scholarly essay.

The history is introduced by an all-too-brief (ten pages) and rather superficial 'geography' of Canterbury's high country, downland and plains. An opportunity was lost here of showing what a geographer could offer in depicting the arena in which interesting human events have occurred and in estimating the extent to which the arena fashioned those events and was in turn moulded by them.

A SURVEYOR ON THE WESTLAND GOLDFIELDS

MY DEAR BANNIE: Gerhard Mueller's Letters from The West Coast 1865-6. Edited by M. V. Mueller. Christchurch: Pegasus Press, 1958 pp. 238, 42s.

This collection of letters was written by a surveyor to his young wife 'Bannie' (an abbreviation of her second Christian name) whom he was forced to leave behind in Invercargill until he was established as a district surveyor in Westland. The letters cover a vital period in the history of the .West Coast—that from September 1865 to August 1866. For the West Coast historian they will prove a valuable primary source, while for the general reader they cannot fail to charm.

Mueller travelled overland to West Canterbury (the official designation of the country from the Grey River south to Jacksons Bay) by the unfinished Otira road, received his briefing at Hokitika, and departed for the far south. His first job was to mark off Maori reserves in South Westland. Like John Rochfort, Richard Sherrin and Arthur Dudley Dobson before him, Mueller found that the Maoris themselves made the best survey hands, and his lieutenant was Kerei, a West Coast Maori of great strength and wisdom.

The letters from Bruce Bay provide the first on-the-spot information of the small 'rushes' in South Westland: the uncertainties of supply; the gradual reduction of the mining camp to a starvation diet of damper, mussels and eels; the excitement when the steamer from Hokitika is sighted; and the wild feasting that follows the landing of fresh foodstuffs. Mueller was disappointed when the beach gold at Bruce Bay petered out, but his heart would surely be gladdened could he see the construction camps of 1958 and know that the Haast Pass road will soon publish abroad the attractions of that remote fastness which he grew to love.

Mueller's duties took him next to the northern part of the West Canterbury goldfields. Although his work usually kept him clear of the hectic mining camps, he gives some vivid glimpses of the bustling life about him: of the lucky Maoris at Greymouth Quay whose land was bringing them rentals of £4,000 a year; of the search for George Dobson who had been garrotted by Sullivan and his unlovely associates; and of Mueller himself, a West Coast Don Quixote, dodging in the dusk bits of half-buried driftwood which he took to be the horns of wild steers driven overland from Canterbury.

Gerhard, Bannie and their small son were eventually reunited in the early spring of 1866 and here the letters end. Bannie's arrival at Hokitika was typical enough. She came by the small steamer *William Miskin* which, like many other vessels before it, ran aground on the south spit.

The letters are edited by Gerhard Mueller's daughter, Miss M. V. Mueller, who has included useful explanatory passages. There are also several valuable appendices and half a dozen good photographs. John Pascoe has provided the foreword.—P. R. MAY

MID-TWENTIETH CENTURY NEW ZEALAND: HISTORIAN'S VIEWPOINT

THIS NEW ZEALAND. By F. L. W. Wood. Hamilton: Pauls Book Arcade Ltd., 1958, pp. 272, 25s.

This is the third edition of a book first published in New York in 1944 under the title *Understanding New Zealand*. The author, who is Professor of History in the Victoria University of Wellington, is an Australian who, despite the fact that he has lived in New Zealand for the last sixteen years, has been able to make a penetrating and discerning assessment of the land of his adoption.

Into less than three hundred pages the author packs an immense amount of absorbing information including, amongst others, chapters devoted to 'government', 'farming', 'industry', 'education', 'the arts', 'war', and 'New Zealand in the world'. But it would be quite wrong to suggest that this is stodgy academic writing; in fact it is extremely easy reading, and the claim on the dust jacket of 'much lightness of touch' is borne out all the way through.

Naturally, into a book of this kind, fact and opinion sometimes become intermingled, for it reads very much as a personal assessment of the New Zealand scene. Not everyone would agree, for example, that the daily newspaper quoted on page 65 can be called 'the best' in the country. Nor would this reviewer agree that 'in the nineteen forties . . . problems of labour and factory sites took new industries to the South Island', or that 'industry and population may soon be drawn strongly by the South Island's greater resources'. But these, after all, are merely opinions set against opinions. The great virtue of this book is that it should stimulate New Zealanders who consider they know their country to ponder a little more about their homeland.

The book has one or two deficiencies. Geographers will be dismayed by the map forming the frontispiece, which, to say the least, ignores some basic elements of cartography. Although liberties are permissible with 'picture maps' some principles must still apply, and there is nothing worse than a bad impressionistic map. The index is not of great help in sorting out references to particular aspects touched upon in the book, and contains some slipshod mistakes. Under Kawerau, for example, the compiler lists the town in the North Island (but gives the wrong page number), and the Kawarau River in the South Island.

Though inexcusable, these deficiencies are minor in comparison with the virtues of the text and the photographs which accompany it. One can agree that the book 'is bound to be of great interest not only to prospective visitors' to New Zealand, and 'particularly to those who contemplate emigrating there'. From the experience of this reviewer a book of this kind would be of much more use at New Zealand House in London than the inadequate literature which was all that was available there in 1954 to the prospective traveller or immigrant.—G. J. R. LINGE

MID-TWENTIETH CENTURY NEW ZEALAND: GEOGRAPHERS' VIEWPOINT

NEW ZEALAND: A REGIONAL VIEW. By K. B. Cumberland and J. W. Fox. Christchurch: Whitcombe and Tombs Ltd., 1958, pp. 270, 18s. 6d.

Post-Primary School Bulletins covering eleven New Zealand regions were published between 1949 and 1953 by the Department of Education. Although based on these bulletins, this book is in most respects a new work. The authors state: 'Its purpose is twofold. The first is to revise, expand and bring up to date the earlier contributions; the second is to put together for the first time within one cover a regional geography of New Zealand.'

Chapter I, intended specifically for teachers, is a very lucid account of the nature of regional geography. The authors emphasise that 'it outlines only one view of the nature of regional geography and that regional geography is but one approach to the description and interpretation of the character of areas.' Their exposition is both illuminating and convincing. Chapter II, dealing with New Zealand as a whole, provides an excellent summary of its outstanding characteristics, with relevant statistics and splendid maps. It is intended as a basis for comparisons—'a yardstick against which other regions . . . can be measured', and as such is quite admirable.

The following eleven chapters cover each a region in turn. The revision and expansion give a comprehensive and well-balanced picture of New Zealand in the mid-1950's. The colourful descriptive passages of the various landscapes have an authenticity that can only come from acute personal observation. Characteristics which make each region distinctive are strongly stressed, and the many helpful comparisons with features in other regions will serve to remind pupils that regions do not exist in isolation. Each of the more populated regions has from four to six maps drawn on a uniform scale giving place names, types of farming, population distribution and other significant elements. The information thus given is most useful, but many of the maps appear to have suffered from overreduction in reproduction—a defect shared with the one graph in the book. Most of the places mentioned in the text may be found in these maps, but not all. In retaining the eleven original regions, the authors have modified boundaries where necessary. Perhaps some future edition might separate the plains and hills of the Taranaki-Manawatu region and promote Central Otago as a region in its own right?

When the original bulletins first appeared, there was general regret amongst teachers that their expression was often too difficult for many secondary school pupils. This book naturally has more uniformity of style, is simpler and better adapted to the calibre of most of its readers. Sometimes an almost Johnsonian broadside such as '. . .the elongated and attenuated shape of Eastland' contrasts sharply with the simplicity of 'Westland is long and narrow'.

Another defect of the original bulletins is rectified by the addition of a first-class chapter devoted to the four major urban centres. As in every other chapter a tremendous amount of information is packed into each paragraph, yet the writing is lively and often stimulating.

The illustrations are a striking feature. The fifty-six photographs are chosen with extraordinary skill, technically are of high quality, and are for the most part excellently reproduced. The notes on these photographs are masterly and it is a pity that they have to be sought in an appendix.

Although this is essentially a textbook for secondary schools, it should have a much wider appeal. Overseas geographers will undoubtedly welcome an authoritative work on New Zealand regions, and many New Zealanders with no formal geographical training could easily find themselves looking at their own country with a new insight and interest. Some books achieve fame through being first in a particular field. This volume is certainly notable and welcome as the first one on New Zealand regions, but intrinsically it is a work of major significance in the geographical literature of the Pacific realm.—R. G. WILSON

ONE HUNDRED YEARS IN HAWKES BAY

THE STORY OF HAWKES BAY. By A. H. Reed. Wellington: A. H. and A. W. Reed, 1958, pp. 312, 25s.

This book, written to mark the centenary of the provincial district of Hawkes Bay, does not purport to be a formal history. The author declares that his purpose 'has been to entertain as well as inform, and while supplying the necessary facts and figures, to relate the history in the guise of what might be termed a social study in story form'. While many readers may believe that a penetrating analysis of the conditions of pioneering in this area of New Zealand, or perhaps fuller treatment of the processes involved in remaking the landscape may have provided a more valuable commemoration of the centenary, it may be agreed that Mr Reed has achieved his aim of producing an entertaining social study.

Mr Reed's achievement is all the more remarkable in that it was completed in less than a year in order to be out in time for the centennial celebrations. While hasty preparation is seldom obvious, it is to be deplored that the local committee did not commission the work at an early date.

The story extends from pre-European times to the end of the 1880's, and is divided into four parts, largely on a chronological basis. The narrative is sound factually, and derives from thorough documentary research, although there is considerable reliance on J. G. Wilson's *History of Hawkes Bay*. The reader is frequently treated to discursive anecdotes about personalities or problems which are highly entertaining, although they prevent the development of a clear theme or an ordered account or major topics.

On most occasions the author is content to let facts speak for themselves, limiting his interpretations and judgements mainly to events in which personalities are involved. Some good word-pictures are included of pre-European Hawkes Bay, although the geographer at least could wish for a fuller reconstruction of the natural landscape and of the life of the Maori occupants. The arduous exertions of explorers are well described, illustrating the very real probelms of isolation and the difficulties of communication—facts that were largely responsible for the separation of Hawkes Bay from the Wellington Province in 1858. The map provided is far from adequate, and many place names referred to are excluded.

It is to be regretted that room is found for many scraps of information about social life at the expense of a fuller treatment of the spread of extensive pastoralism and of the life and problems of farmers at this time. In particular, too little attention is given to pastoralism in the Wairarapa as the local 'source area' from which early movement into Hawkes Bay occurred of men, animals and locally-adapted techniques. Economic and social development are mainly treated as purely local phenomena, although some attention is directed to the relationship between the port of Napier and its tributary region and the intrusion of significant national events and market prices on the local scene. Statistics of agricultural production are used with discrimination to show how Hawkes Bay has progressed.—R. F. WATTERS

MAN AND LAND IN THE WESTERN PACIFIC

WESTERN PACIFIC: Studies of Man and Environment in the Western Pacific Wellington: Department of Geography, Victoria University of Wellington, and the New Zealand Geographical Society (Wellington Branch), 1958, pp. 82 (mimeographed), 5s.

Following the success of *New Zealand: Inventory and Prospect* published in 1957, the Wellington Branch of the New Zealand Geographical Society has again gathered into a companion volume the series of papers given in the following year. Despite the disadvantages of mimeographed reproduction, *Western Pacific* is an improvement on the previous volume, for the maps have been better reproduced, and the covers use most effectively an all-over pattern of a Samoan *siapo* design. The editing, however, must be described as 'tolerant'. Among other things, no two authors followed identical systems of foot-noting, and only in the two-page Introduction were the conventions adopted by other publications of the New Zealand Geographical Society observed. Occasionally, too, the excessive use of jargon obscured rather than illuminated.

The papers included in *Western Pacific* cover a wide range. In 'Aspects of European Contact in Central New Guinea' Dr F. J. West discusses the beginnings of European penetration into the New Guinea highlands, 'the last major colonial area in the world where there live natives who have yet to see a white man'. Dr West points out that the course of future contact between these highland peoples and Europeans is probably the only remaining case to be examined at first hand. Professor L. H. Palmier's paper, 'Constitutions and Geography in Indonesia', deals with both the agricultural history and the geography of the archipelago, and lucidly explains the situations leading to the separatist movements in the outer islands against the central Javanese-dominated government.

'The Peopling of the South Pacific' by J. Golson brings an archaeological approach to a problem which has had much publicity in recent years. The best effect of this has been to create widespread interest in the topic, and to stimulate further research into the processes of Polynesian settlement. Slowly the details are being unearthed, and a credible sequence is emerging. Perhaps the main point to come out of this paper is an indication of how little is yet known, and how much may be discovered by systematically employing archaeological techniques. To conclude a paper of exceptional interest and value, the special characteristics of Maori settlement in New Zealand are related to the settlement of tropical Polynesia.

Recent evidence has indicated that Samoa is likely to have a more important place in the sequence of Polynesian dispersal than was previously thought. Recent research suggests that settlement has been established for at least 2,000 years in Upolu, and Dr R. Watters's paper, 'Culture and Environment in Old Samoa', is therefore timely and significant. He sets out to demonstrate how the low intensity of resource utilisation and the evidence of rigidity, and even regression, in the Samoan culture is related principally to the 'very wealth of potential resources offered by an environment'. The evidence has been presented with skill and insight.

One may, however, question the usefulness of the interpretation of the Samoan islands, only 1,211 square miles in area, simple in their geological structure, rocky, and of thin soil, as providing a 'lotus-eater' environment for 80,000 persons, the estimated population before the advent of Europeans. While the production of food is not difficult, there is little reason to believe that food production was any easier in Samoa than in many other tropical areas, including several Pacific islands. It seems safer to assume that the Samoans were content, for social and psychological reasons not yet fully demonstrated, to make very modest demands upon their lands, and that their appraisal of the resources of their islands, haphazard and casual as it is, cannot be adequately explained by the inevitability of a 'stultifying influence' of a 'bountiful physical environment'.

The last paper concerns New Zealand directly, and James E. Ritchie in 'Race Relations and the New Zealand Maori', examines a subject which will merit greater attention in the future than it has received in the past. New Zealanders have been very ready to take the credit for solving a situation which never presented them with any great problem. However, there are signs that what may have passed for a progressive attitude in the nineteenth century is now becoming increasingly inadequate. Mr Ritchie, then, has performed a very useful service in drawing attention to the demographic separateness of the Maori component in New Zealand's population. As it is increasing at a rate approximately twice that of the European component the situation could very easily deteriorate rather than improve. His analysis of the wants and aspirations of the Maori, and his suggestions on the ways in which they could be satisfied, are both revealing and stimulating. This paper, particularly, makes one wish that *Western Pacific* had been designed to have a wider circulation.

—Peter Pirie

Land and People in Hong Kong

LAND USE IN HONG KONG AND THE NEW TERRITORIES. By T. R. Tregear. Hong Kong: Hong Kong University Press, 1958, pp. 75, 12s. 6d.

Dr Tregear's monograph is the first of the country memoirs planned by the World Land Use Survey. The extension overseas of the series of British land-use studies initiated by Professor L. D. Stamp and his fellow workers is a significant development in providing a better understanding of the relations between man and the land, and, at the present time, when an expanding world population is pressing heavily upon available resources, it is particularly to be welcomed.

The volume provides an analysis of land use in Hong Kong and the New Territories along the well-trodden lines of the British county monographs—new wine, or heady rice wine, in old bottles! It is useful to have the full account of the physical setting of agriculture (30 out of 66 pages), though some aspects, such as soils, are very sketchily treated. At the same time, bearing in mind the author's statement (p. 61) that social and economic conditions are 'equally important with physical conditions . . . in obtaining an optimum use of the land', it is unfortunate that the data on the social background should be so scanty. Some four pages are devoted to rural social conditions; the author comments on the 'very serious lack of statistics and data' on this aspect but apparently made no attempt to rectify this deficiency. In consequence, no data for the total farm population is given and, while four sample budgets are given for the 'social expenses' of farmers, there are no figures which would give a picture of the general levels of living of a farm family or of the output per holding. Land has gone out of cultivation because of 'the attractions of city life' (p. 42); bearing in mind the overcrowded slums and festering poverty of Hong Kong or Kowloon, one wonders just *how* low living levels are on the farms of the New Territories.

The general picture of land use can be summarised briefly. Out of an area of rather less than four hundred square miles thirteen percent is arable, some seventy-three percent is covered in grass or scrub, five percent is under forest or marsh, a little more than four percent consists of heavily eroded 'badlands', and almost four percent is built over or agriculturally unproductive. On the basis of 1941 figures, almost twelve percent of the population (the total for Hong Kong in 1956 was over 2.5 million) lived in the New Territories, though what proportion of these were actually engaged in agriculture is not clear. The farmers of the colony produce one half of Hong Kong's vegetable needs and twelve percent of the pork and poultry needed. Fishing plays an important part in local life; almost 150,000 depend on fishing, and fish ponds are an important element in the rural landscape, giving a return per unit area twice as great as padiland.

No maps or details of sample holdings are given and the problem of parcellation, if it exists, is not discussed. The insatiable demand of Hong Kong for water leads to a conflict of interests between town and country; the extension of catchment areas leads to loss of land to farming while tunneling in connection with the construction of reservoirs lowers the water table and leads to the drying-up of springs.

Two general points may be made. First, it is to be hoped that later volumes in the series will break away from the rather stereotyped approach of the British county monographs. As a contributor to this series many years ago, the reviewer finds himself increasingly conscious of some of the deficiencies of these surveys, above all of the need for a much greater emphasis on the social and economic conditions of farming. The extension of the project to non-European areas where the cash-oriented character of English farming may be absent, where conditions of tenure are vastly different, and when non-physical, non-economic factors such as religious attitudes may play an important role in shaping the land-use pattern, would seem to call for a departure from the old patterns of investigation and for a much closer attention to the cultural setting of agriculture.

Second, the choice of Hong Kong as the initial study in this new series is in some ways an unhappy one because of the very unusual character of the colony. Over most of Hong Kong Island and a large proportion of the New Territories urban interests, in the shape of water conservancy, have crowded out the farmer. Political conditions have resulted in an abnormal expansion of the colony's population, whilst increasing population pressure has meant that land which under normal conditions would be quite marginal has been brought into cultivation. Hong Kong is scarcely a representative east Asian area, and for this reason it is to be hoped that the series will be organised to include also sample studies of land use in China itself, contributed by the very active school of Chinese geographers now working on land-use problems.

Dr Tregear's study may be supplemented by his studies of the urban geography of Hong Kong made in collaboration with L. Berry. These were published in the *Far Eastern Economic Review* and were reprinted in 1958 under the title of *The Development of Hong Kong*.—KEITH BUCHANAN

NEW TEXTS FOR ASIAN STUDIES

THE PATTERN OF ASIA. Edited by Norton Ginsburg. New York: Prentice-Hall, 1958, pp. 929, $11.65.

AN ECONOMIC GEOGRAPHY OF EAST PAKISTAN. By Nafis Ahmad. London: Oxford University Press, 1958, pp. 361, 50s.

The appearance of two new substantial volumes on the geography of Asia is to be welcomed. The new American text on the Asian continent has been long awaited. The editor, Norton Ginsburg, and co-authors, John E. Brush, Shannon McCune, Allen K. Philbrick, John R. Randall, and Herold J. Wiens have produced a reasonably up-to-date work which, for advanced students, is very likely to replace other standard texts on the geography of Asia as a whole. Within the compass of some nine hundred pages is provided a good combination of L. D. Stamp's solid, factual approach and George Cressey's flowing description.

After a relatively short introduction on the physical character and human problems of the continent, the work moves into an analysis of each major country. A detailed systematic discussion precedes each regional interpretation. The highest commendation is warranted for the valuable, detailed and clear maps. Many of them were specially prepared for the text and are, in themselves, first-class pieces of research and of cartography.

To some geographers the section on China since 1949 will appear weak. This may be due, in part to the rapidity of change in China and to the delay in publication.

Nevertheless, in reading the text it is possible to underestimate the economic productivity of China today. Yet, to those interested in the Asian scene, layman, student and teacher, this book is worthy of close study.

In contrast to Ginsburg's very broad study, Nafis Ahmad looks closely at the eastern part of the Republic of Pakistan in his new book, *An Economic Geography of East Pakistan*. 'Yet, without industrialisation, East Pakistan is a miserable, overcrowded agrarian slum.' This abrupt sentence from Professor Spate's well-known volume *India and Pakistan* (p. 552) might well be the conclusion drawn from Professor Ahmad's book. However, one can never imagine Professor Ahmad using it, not at least after reading this book. That is not to say, however, that Professor Ahmad does not realise and discuss the essential problem of East Pakistan.

This book is very welcome. It presents a clear, concise, geographical account of East Pakistan in time and space. In the preface the author acknowledges his debt to Professor L. D. Stamp whose energy and initiative have inspired so many students in so many parts of the globe.

Professor Ahmad presents a neat and orderly arrangement of his material. The first sixty pages and sixteen maps describe the physical setting in which water from river and air is so vital. The next forty pages and four maps are entitled 'Economic Geography of the Past'. It is essentially developmental in treatment. The third part, of 210 pages and thirty-six maps, is a systematic treatment of the economic geography of East Pakistan today, its agriculture, forests, industry, transport, trade and population, and it concludes with a chapter on present and future development.

In three main respects this reviewer would wish for fuller discussion. The religious aspect is virtually neglected and there is no analysis of Hindu and Moslem elements in the population. Land tenure and fragmentation of holdings receive scant treatment, while the relationships of East and West Pakistan are barely mentioned.

Apart from the numerous maps there are many valuable statistical tables. In format the Oxford University Press has been commendably generous. All maps are full page and clear and some authors might well follow the principle adopted here of including a scale on every map, but the absence of latitude and longitude (or a direction arrow) on all but two maps cannot be approved.

Nevertheless the appearance of this detailed study of a part of Pakistan is most welcome and it is hoped that more will appear to cover other regions in Pakistan and India, for it is at this scale of regional study that the geographical literature of Monsoon Asia is sadly lacking.—W. B. JOHNSTON

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